Skyways

Flight
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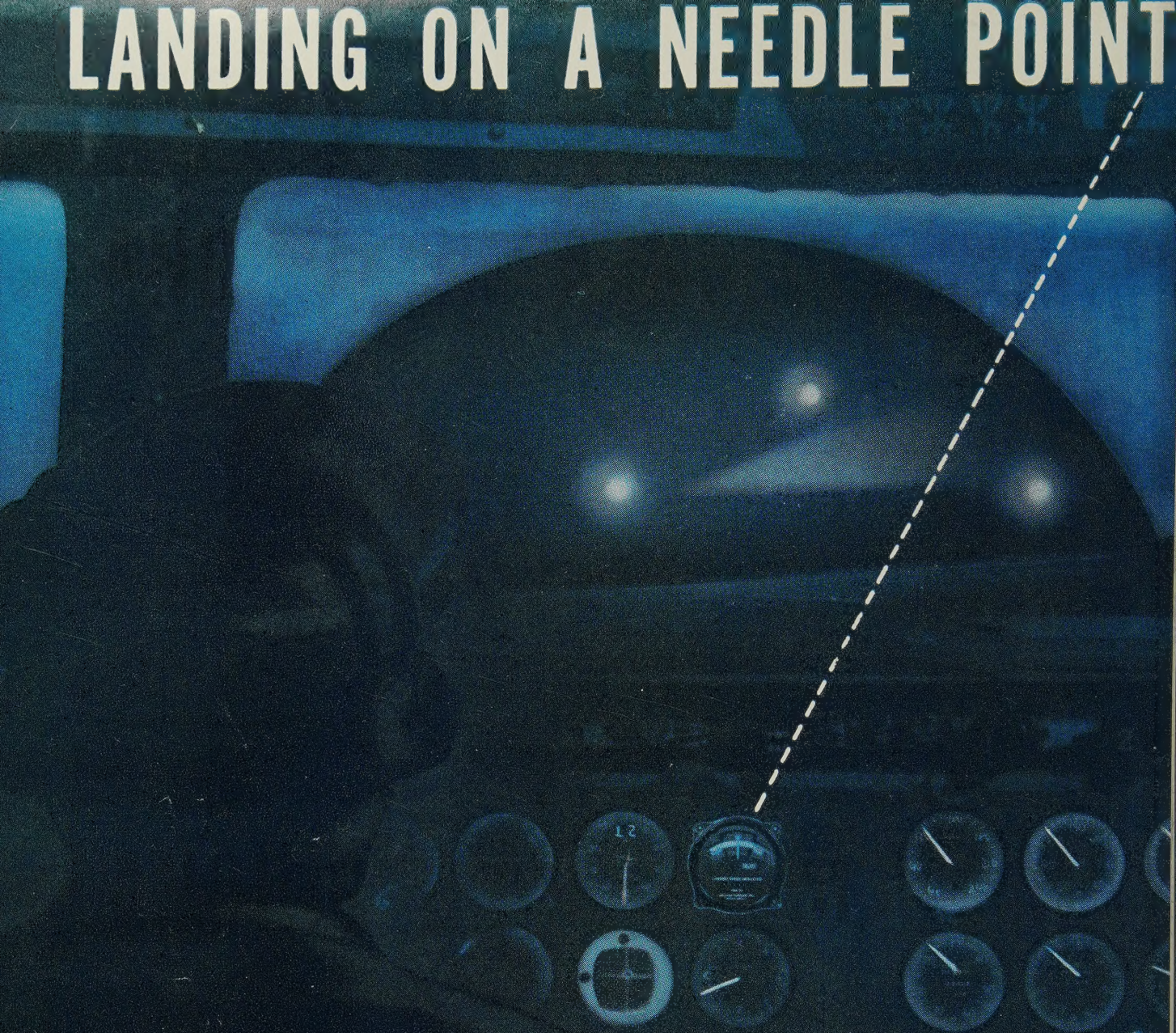
LANDING ON A NEEDLE POINT



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SAFE FLIGHT INSTRUMENT CORPORATION

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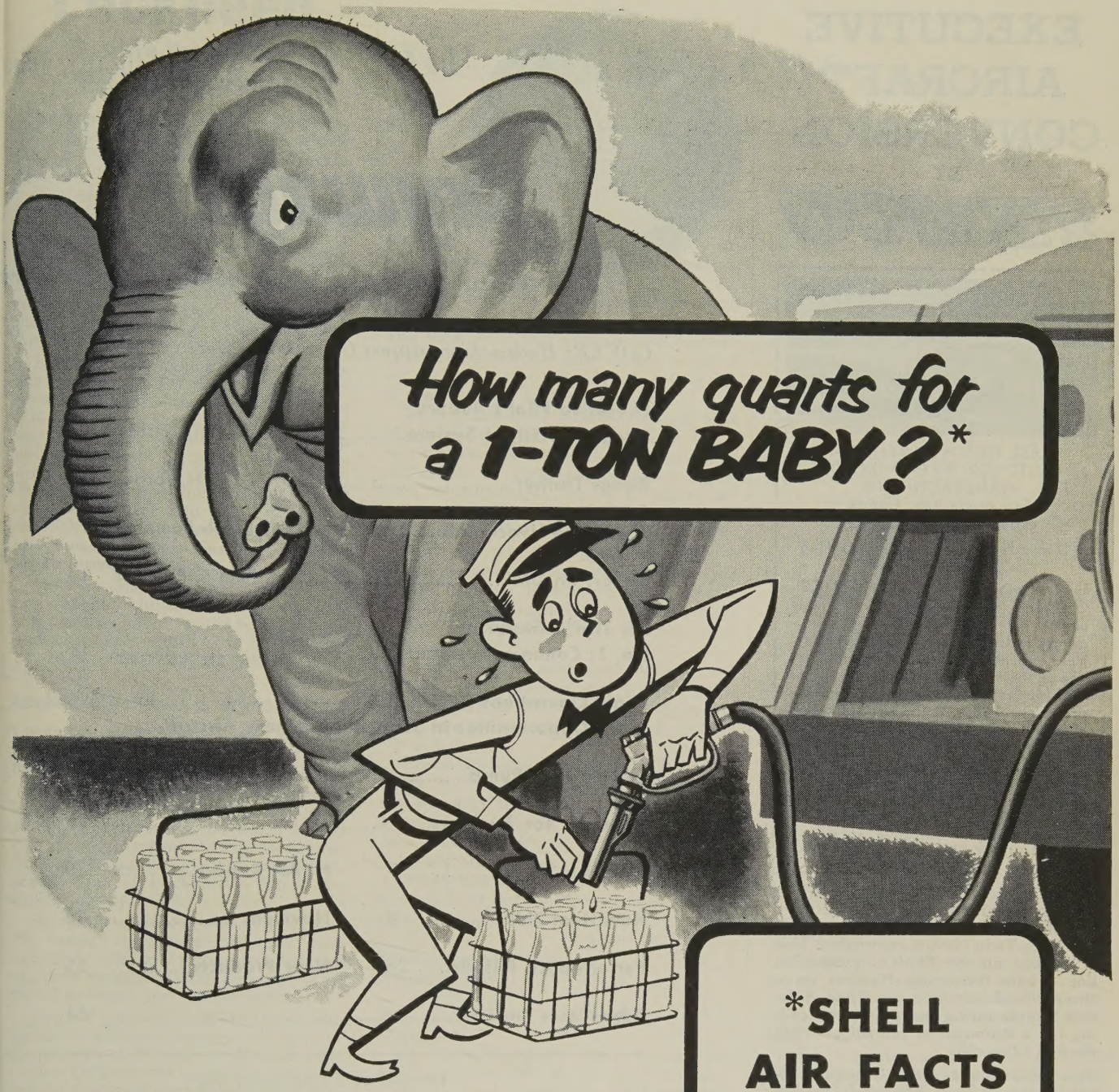

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AUGUST, 1953

Skyways

Flight Operations • Engineering • Management

COVER: Hydro-ski-equipped Convair Sea-Dart

FOUNDED BY J. FRED HENRY, 1942

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SKYWAYS is the official publication of the National Business Aircraft Association.

MEMBER AUDIT BUREAU OF CIRCULATIONS

VOLUME 12, NUMBER 8

SKYWAYS is published monthly by Skyways Publishing Corporation, 444 Madison Ave., New York 22, N. Y. Advertising Offices: Henry, McIntosh & Simpson, 444 Madison Ave., New York 22, N. Y. West Coast Reps., Henry McIntosh & Simpson, 816 W. 5th St., Los Angeles 17, Cal. Mid-West Office: 230 E. Ohio St., Chicago 11, Ill. Printed in U.S.A. Single Copy: 50c. Subscription Prices: U. S. possessions, Canada and Pan-Am. Union $9.00 for 3 years, $7.00 for 2 years, $4.00 for 1 year; all other countries add $1.50 per year for postage. Six weeks required for address changes (give both old and new). Manuscripts, drawings, other material must be accompanied by stamped, self-addressed envelope. SKYWAYS is not responsible for unsolicited materials. Reentered as second-class matter April 16, 1948, at the post office at New York, N. Y., under the act of March 3, 1879.

air your views . . .

Turboprop Testimony

Gentlemen:

I have just flown from Rome to Istanbul and back here to Athens aboard one of British European Airways' turboprop *Viscounts.* Both flights were smooth, quiet, and fast. Captains Wright and Jones were kind enough to allow me to spend an hour in the cockpit with them while they explained the controls. I've flown C-54's and have ridden on all of our major transports, but I don't believe any of them compare with the *Viscount.*

When I arrived in Athens, I bought your May, 1953 issue and read "Trends in Transport Engineering" by William Littlewood. In this article he states that it will be impossible, or improbable, for us to perfect the turboprop engine before jet powerplants suitable for this medium-haul work are available.

It irks me that the English can have this turboprop airplane in operation for seven months while we don't have a similar one for scheduled operation even in the foreseeable future; that the *Comet* is a common sight over here.

I realize we can make more airplanes, but why can't we make the best? I hope the answer is that all our brains and efforts are going into jet bombers . . . and that we have the best there.

This is probably a rather dull blow-off of steam, but Mr. Littlewood's article on American transport trends wasn't very impressive after having seen the progress the English have made over here.

On the brighter side, I enjoyed your magazine very much and intend to see it regularly when I get home to Pennsylvania. I have a private strip and own a Cessna 170.

DAVID C. PEACE

Hotel Grande-Bretagne
Athens, Greece

Slip or Skid

Gentlemen:

Re. Capt. Sheridan's article in the June issue: "Slip or Skid for X-wind Landings," I believe a combination of both methods is the solution. The upwind wing must be kept down to avoid the danger of being blown off the runway (like wearing a straw hat in a strong wind . . . you cock your head into the wind just enough to keep the hat from blowing off). The angle, of course, depends on the wind velocity. In an airliner that probably would not make much difference, but in a lighter aircraft it would.

And the use of rudder is essential to keep the slip pointed down the runway and, being the last control to leave you, good control is established throughout the landing roll. At times this means cross-controlling which we all know is wrong, but we use it anyway. At the field I used to use (60 ft. x 1800 ft. at sea level), pilots had more trouble in a "no-wind" condition than they had in a crosswind.

A1/C R. T. STEGMAN

AF #19384189
681st A. C. & W. Squadron
Cut Bank, Montana

On-the-Spot Arrivals

Gentlemen:

After reading your article concerning "On-the-Spot Arrivals," I was glad to see that somebody is thinking about the present fouled up situation that now prevails at busy terminal airports. The "Spot System" is a definite improvement on the present "hit-or-miss method." The safety factor would be increased, but I don't think it would cut down superfluous transmissions as much as you think. To me, the "Spot System" seems like sort of a VFR approach control, holding aircraft over two or three visual check points. Therefore, if this system is to be run on the first-come first-serve basis (as it should be run), you're going to have a "red hot mike" by the time you get your traffic down. It would be almost mandatory that the pattern be very close, and it certainly wouldn't be healthy if they overlapped.

At Norfolk Naval Air Station where I'm employed by Uncle Sam we have the same problem with our inbound traffic (we have 300 to 400 landings a day). But our problem is alleviated by the fact that the majority of the aircraft are the single-engine type and a close traffic pattern can be maintained.

A system that we sometimes use during the heavier period could be modified for civilian use. After initial call, the pilot should be advised to check with the tower when he's approaching upwind over the active runway (say, about a mile out, maintaining 1500 feet), for tower clearance for an approach. If he is to be cleared for an approach, he should be maintained. In this manner you can give an aircraft an approach sequence number as soon as he checks upwind.

Example:

"Oopsville Tower. This is United 321 turning initial 1 mile out. Over."

"Roger, United 321, you are cleared to continue two behind DC-6 now turning downwind."

Using this system, all the aircraft in the pattern are under strict and positive control. The tower operator on duty can easily discern any aircraft in the pattern. This system promotes (quote from the ANC Manual) "safe, orderly and expeditious control of air traffic."

In any event, some sort of a system is sorely needed at our terminal airports. Most anything would be an improvement.

E. E. MATTHEUS

Operations—Tower—L.P. 1
NAS, Norfolk, Va.

Here's Hy's reply: "My first idea was just a primer to see if we could not get some more and better juice from other minds. It seems to me the method would cut down a lot of radio chatter. When I report over my own individual check spot, I am cleared to land . . . usually, but I may be told to hold. The next bit of conversation is that I am cleared to land. That's not much jabber. None of this where-are-you, show-a-light, do-you-see-United, etc. Now I know why operators blow into their mikes—to cool 'em off."—Ed.

...now hear this

PERSONNEL

John Jay Hopkins, board chairman and president of General Dynamics Corporation, was elected chairman of the board of Consolidated Vultee Aircraft, succeeding Floyd B. Odlum, president of Atlas Corp.

James E. Davis joined Seaboard & Western Airlines as operations engineer. He was formerly project engineer for American Airlines.

Fred W. Soule has joined Doman Helicopters, Inc., as Assistant Sales Manager.

James S. Cobb, vice president-public relations of Delta Air Lines, was elected Chairman of Public Relations Advisory Committee of ATA. **Willis Player** of Northwest Airlines was named Vice Chairman.

C. S. Ferguson has been appointed director of engineering of Marshall-Eclipse Division of Bendix Aviation Corporation.

W. G. Rhodes and **Kenneth W. Whisler** joined Cessna Aircraft as Military Representatives. Both men will assist Cessna's Government Contract Representative, Derby Frye, on military projects.

Adm. H. B. Sallada (USN-Ret.) has been appointed assistant general manager of Chance Vought Aircraft Div., United Aircraft Corp.

Maj. Joseph Egy, USAF, has joined the Executive Engineering staff of Gavco Corp., a subsidiary of General Aviation Corporation.

Jack Sidebottom, former Assistant Director of Technical Service of AIA in Washington, D.C., was recently appointed Engineering Manager of Flight Refueling, Inc.

Dr. Michael J. DiToro now heads electronic development in Fairchild Guided Missiles Division's engineering department.

Ronald Peel, chief navigator for TCA, has been appointed supervisor of ground training. **D. H. Gray** has been named Director of maintenance and overhaul for TCA.

Chet Pearson has joined Beech Aircraft Corporation as vice president in charge of manufacturing.

Thomas Wolfe, president of Pacific Airmotive, was elected chairman of the board; **H. H. Greenwald** was elected treasurer and assistant to the president, PAC.

L. Eugene Root, aeronautical scientist, was appointed Director of Development Planning for Lockheed Aircraft.

Charles Kirchner, assistant to the president, Kaman Aircraft Corp., has been appointed publicity chairman of American Helicopter Society.

COMPANIES

Seaboard & Western Airlines, largest U.S. all-freight air carrier on the North Atlantic, recently completed six years of over-ocean operations by chalking up its 1,931st crossing of the Atlantic. Seaboard presently operates a fleet of 10 DC-4's.

Goodyear Aircraft Corp. is producing component parts for a reconnaissance version of the Boeing B-47 for the USAF.

Northrop Aircraft has sold its school division, Northrop Aeronautical Institute, to **California Flyers School of Aeronautics** in Inglewood.

New airplane engineering and modification facilities have been opened at Clover Airfield in Santa Monica, Cal., by **Lear, Inc.** This new facility will supplement the Grand Rapids Hangar operation and provides factory service both in the East and West. *Lodestar* aircraft modification will be available only at the West Coast hangar.

Sabena Belgian Airlines has concluded an agreement with the Netherlands Government which permits the company to inaugurate the world's first scheduled international helicopter passenger service between Brussels, Antwerp and Rotterdam. Operations will begin on August 1. A second and third route are to be opened soon.

AWARDS

Major J. Slade Nash, USAF, was awarded a Distinguished Membership in the Jet Pioneers Association for signal contributions to jet aviation.

The Wright Brothers Medal of the Society of Automotive Engineers was awarded to **William J. Kunz, Jr.,** chief engineer of fuel-metering electronics at Bendix Aviation's Products Division. The gold medal "for meritorious contribution to aeronautic engineering" was presented to Kunz for development of electronic equipment which reduces the time required for fuel-system testing on jet engines.

CALENDAR OF AERO-EVENTS

July 3-7—Seventh All-Women Transcontinental Air Race from Lawrence, Mass., to Long Beach, Calif.

July 4-5—Dedication of Coles County Airport, Mattoon, Ill.

July 9-12—Sixth International Aviation Exposition, Wayne County Airport, Detroit.

July 15-16—IAS Annual Summer Meeting, Honors Dinner, IAS Bldg., Los Angeles, Calif.

Aug. 2—Amarillo, Texas Jaycee Air Fair. Observance of 50th Anniversary of powered flight. Tradewind Airport.

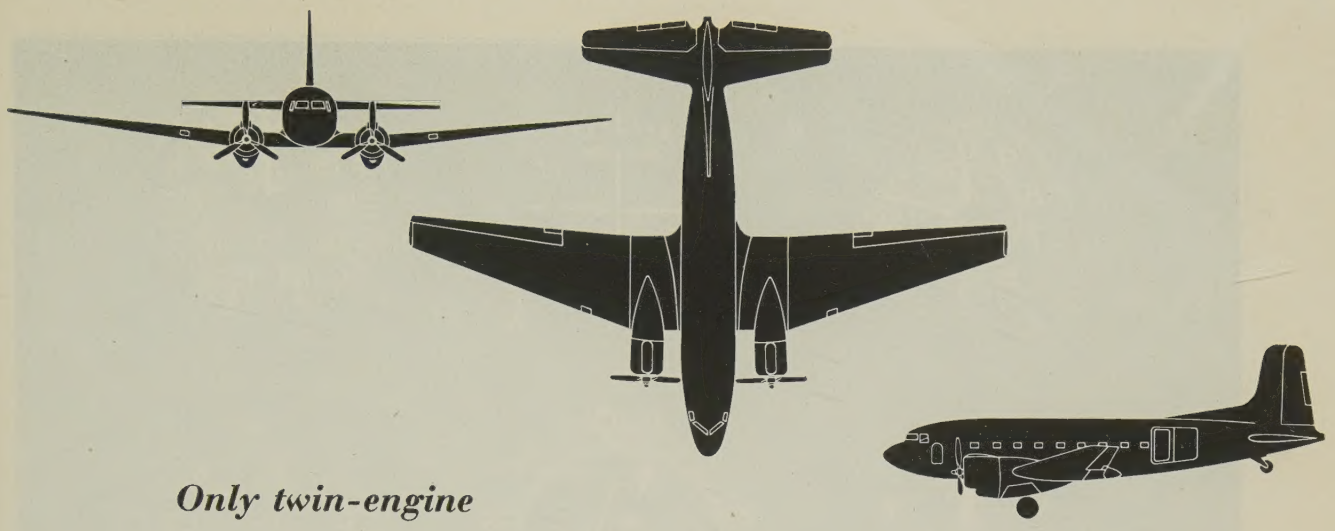
Aug. 19-21—Western Electronic Show, Convention. Civic Auditorium, San Francisco, Calif.

Aug. 25—Ninth legal committee meeting, ICAO, Rio de Janeiro.

Sept. 5-7—National Aircraft Show and 50th Anniversary of Powered Flight. Dayton, Ohio, Municipal Airport.

Sept. 7-17—Fourth International Aeronautical Conference, joint meeting of RAeS and IAS, London.

Sept. 12-13—Third Wisconsin Air Pageant, at Curtiss-Wright Airport, Milwaukee, Wis.



Only twin-engine

transport that makes regular flights

to Hawaii, the Navy's

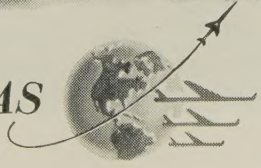
Douglas R4D-8

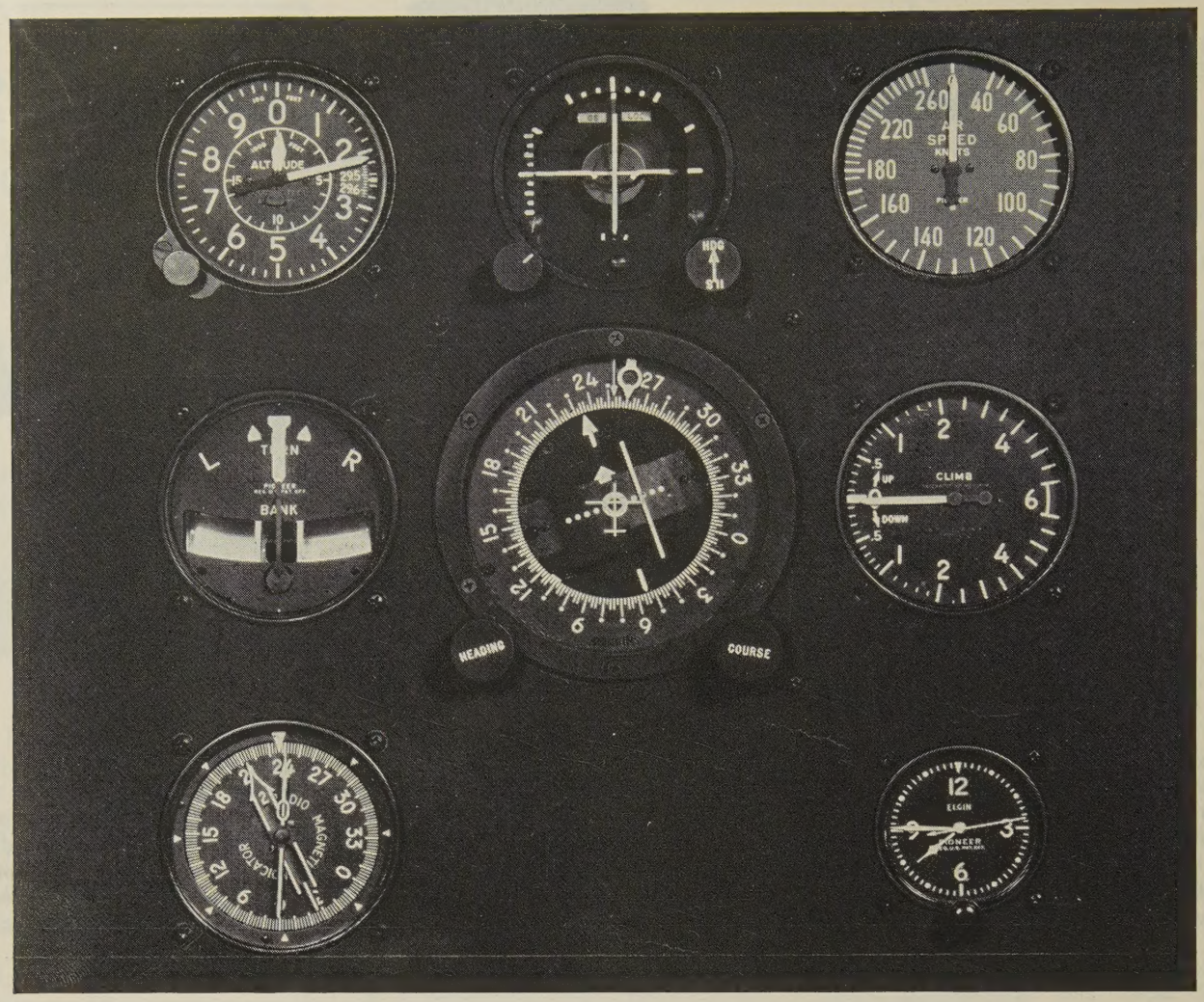
Unique among twin-engine aircraft is the Navy's Douglas R4D-8. On orders, this transport can take off at San Francisco and safely wing its way across 2,562 miles of open Pacific to Hawaii.

Born of the Douglas DC-3, world's best known airplane, R4D-8 is longer, more powerful and flies on new swept wings. It carries 2,800 more pounds of payload 45 m.p.h. faster than its famous parent. Ceiling and range are greater. Passenger and freight loading are easier, quicker. And along with its improved performance, the Douglas R4D-8 still combines DC-3 reliability with twin-engine economy.

Development of the R4D-8 is another example of Douglas leadership in aviation. Planes that can be produced in quantity to fly *faster and farther with a bigger payload* are a basic Douglas rule.

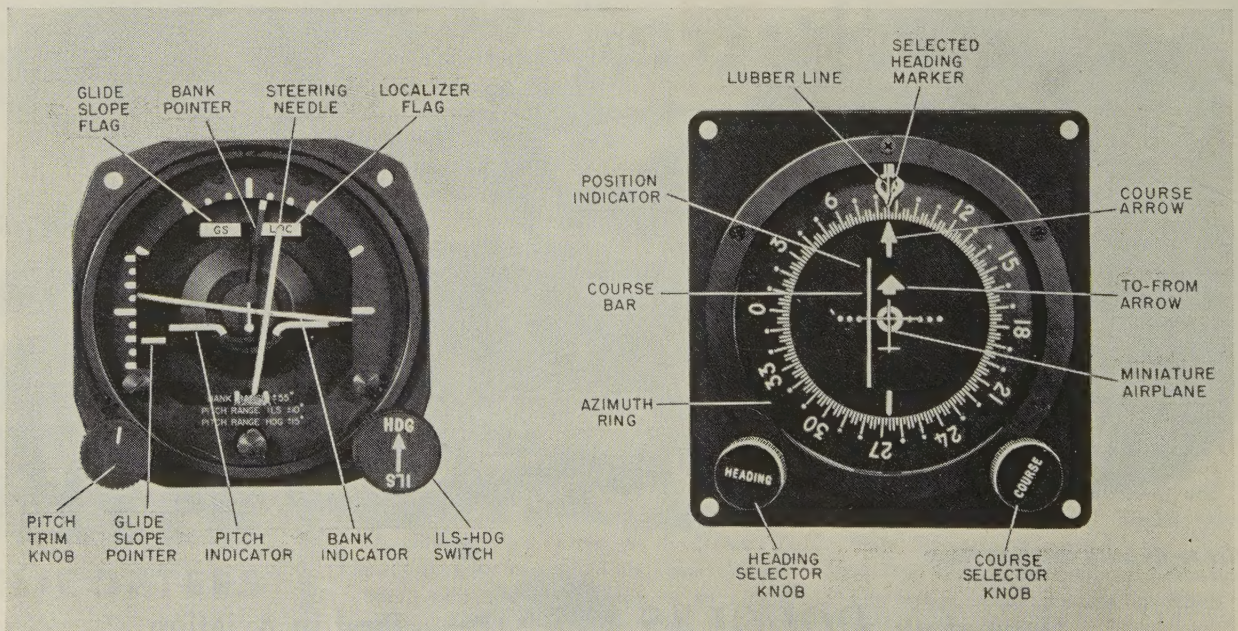
Enlist to fly with the U.S. Navy

Depend on *DOUGLAS*  **First in Aviation**



COLLINS *Integrated Flight System, as shown on mock-up (above), reduces instruments on flight panel from 12 to eight. Approach horizon is in middle of the top row, the course indicator directly below it. Other major components of the system are a vertical gyro and a steering computer. These plus the computer shockmount weigh only 29.3 lbs*

APPROACH HORIZON *(below, left) displays glide slope position, aircraft attitude and steering information. Localizer meter service is provided by course bar of course indicator (below, right). The course bar of the CI serves for VOR service in same manner as vertical needle of FPDI meters. Course indicator is connected to output of navigation receiver*



executive pilot's report

Integrated Flight System

Collins System gives pilot a clear picture, on fewer instruments, of all information needed and tells what to do next for precise ILS approaches

by Herb Fisher
Chief, Aviation Development, Port of N. Y. Authority

If you are tired and weary of bracketing the localizer course like a weaving reptile during ILS approaches, you're ready for the surprisingly simple and effective "fly by picture" integrated flight system developed by Collins Radio Co.

This new system is designed primarily for precise ILS approaches, but it also is an easy and simple means of flying VOR tracks and magnetic headings. It gives the pilot a clear picture, on fewer instruments, of all the vital information when it is needed and tells him precisely what to do next.

I had never flown the system before Dick Phipps, a congenial and proficient sales pilot, and I took off from Teterboro in the Collins Twin-Beech a few weeks back. By the time we returned to the New Jersey field that afternoon I was flying it like a Collins veteran. The flight system is that easy to master. It is said that a picture is worth a thousand words, in this case the picture simplifies what has been in many instances a complex procedure.

The major components of the Collins system are the approach horizon and the course indicator, but don't let labels confuse you. The approach horizon is a roll-and-pitch reference similar, in appearance and function, to a standard artificial horizon. In the Collins system, however, it is a busier and more informative instrument because it also includes position information with respect to the glidescope, and steering information for ILS approach flying. The pilot's other handy little helper, the course indicator, is a compass card upon which is superimposed a picture of the aircraft's heading and displacement in relation to the ILS or VOR course.

In fact, on just one of them—the approach horizon—you get, for the first time on a single instrument, attitude *and* steering info on both localizer and glidescope. Together, these instruments, tied in with a steering computer and a vertical gyro, add up to a new and improved type of VOR and ILS instrumentation.

For peak performance during ILS approaches, when you need clear pictures of your airplane's position and movement and precise steering information, let's switch to the Collins system.

Suppose you are flying a 70° course to the omnirange, the runway heading is 270° and the heading from the onmi-station to the outer marker is 340°. Here's all you have to do: Proceed to the omni-station and change your heading on the course indicator to 340°. Fly that heading to the outer marker but, before crossing it, tune your glidescope and navigation receivers to the proper ILS channels. When you are within range of the ILS station and receiving an adequate signal, the GS and LOC flags on the approach horizon will disappear.

Turn the ILS-HDG switch on the lower right side of the approach horizon to the HDQ position. On the course indicator, turn the heading and course-selector knobs to set the heading marker and the head of the course arrow to the inbound localizer course (270°). You'll see the course bar on the course indicator deflect and move out ahead of the miniature airplane.

As you turn at the outer marker to the outbound course, the miniature airplane will line up with the course bar and you'll be flying away from the course arrow and heading marker. The outbound heading will show at the lubber line on the compass card.

On the procedure turn, note that the course bar and the little airplane will show your position and movement relative to the localizer course during every second of the 180° turn. You're flying by picture. The course bar on the course indicator is the course you want and you always know exactly where it is in relation to your airplane's heading. You can

CHECK PILOT *Herb Fisher (left) goes over details of the Integrated Flight System with Dick Phipps (right), Collins sales pilot, before take-off on evaluation flight at Newark*

see it as easily as you can see a broad white line painted on the ground.

As you turn into final approach, the course bar will line up with the head of the course arrow, the heading marker, and the lubber line. The miniature airplane will line up with the course bar. In fact, everything will be lined up on the course indicator and the heading will be 270°. You're riding that localizer course.

If you've been wondering what happened to the approach horizon during this trip to the outer marker and the procedure turn, the answer is practically nothing. Steering information was there, but we haven't used it. But now that we've begun final approach, the approach horizon is going to be a very handy gadget to have around.

On the approach horizon are a steering needle, an ILS-HDG switch, a horizon bar, a bank pointer, a pitch bar, a pitch trim knob and a glideslope pointer.

You're inbound and the heading marker is set to the localizer course. Right here, just before you pass the outer marker, change the ILS-HDG switch to ILS and use that steering needle on the approach horizon.

As the glide slope is intercepted, you'll see the glide-slope pointer begin to move down from the top of the scale on the left side of the approach horizon's face. That little white horizontal line is your airplane. When it is below the center of the scale, your airplane is below the glide slope. You merely fly the picture, matching the pitch bar with the glide-slope pointer to keep on the glide slope. Keep the steering needle centered at all times and here's why: automatic correction for crosswind is provided when you keep the steering needle centered. A glance at the course indicator shows that your drift angle is the difference between the head of the course arrow and the lubber line. But you don't have to keep correcting for it if that steering needle is on dead center on the face of the trusty approach horizon.

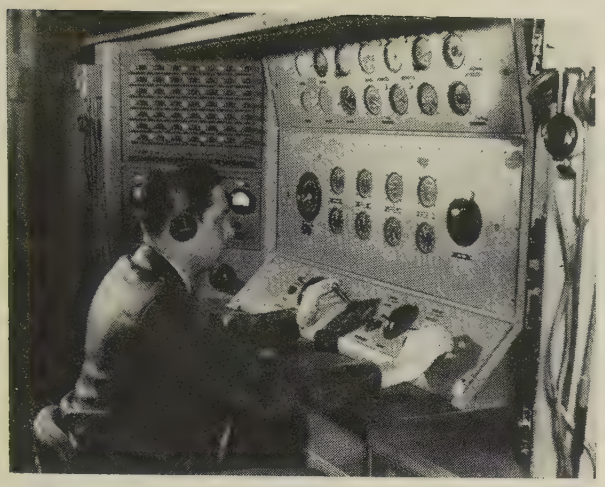
You're past the outer marker, having lowered gear and flaps and made proper power settings. The course indicator shows your airplane on the localizer beam. Keep the steering needle centered and keep the pitch bar matched with the glide-slope pointer. You break through and the runway is there just where the instruments said it would be. You touch down. You've just completed a "fly by picture" ILS approach without snaking all over the localizer course—and without violent maneuvers after break-through. It is my opinion that missed approaches will be few and far between with this equipment.

Our Twin-Beech also was equipped with the new Collins Type 560C-1 navigation computer, which makes it possible to fly a selected course to destination within the useful area of two local omnirange stations. For an ILS approach, the computer can be arranged to give a continuous reading of distance to touchdown. Distance to touchdown is figured on the basis of the triangle formed by the positions of the aircraft, the omnirange, and the touchdown point.

The computer comprises a card reader into which the pilot inserts a pre-coded punch card; a standard waypoint selector showing azimuth readings and distance in miles; and a distance indicator. The equipment can be used in various combinations, depending upon whether the airplane has a dual VOR receiver installation or DME or both. Briefly, the computer utilizes information from CAA ground radio facilities to provide navigational information with respect to an arbitrary waypoint. It uses the punch-card system to store information on checkpoints along a route between starting point and flight destination.

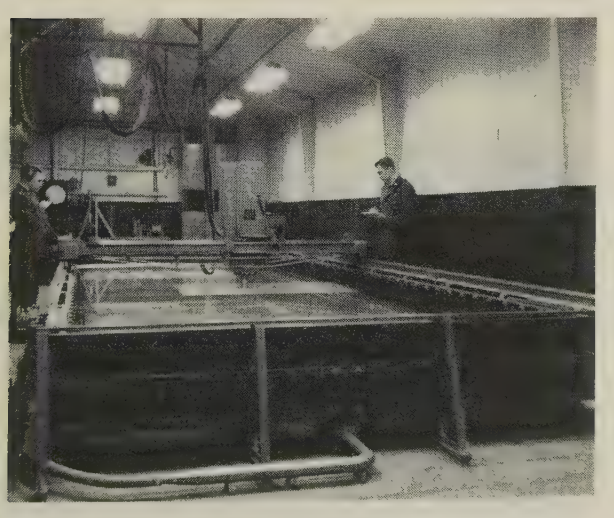
The Collins integrated flight system is effective, too, for flying compass headings and omni-courses during enroute navigation. To fly a compass heading, turn the ILS-HDG switch on the approach horizon to HDG and adjust the heading-selector knob on the course indicator to the desired heading on the compass ring. The steering needle on the approach horizon will remain centered as long as the airplane is on the selected heading. The needle will deflect as deviations from the heading or from level flight are made. Center the needle and you're back on course.

Simultaneously, you can use the system for flying omni-courses. With the ILS-HDG switch at HDG, tune the navigation receiver to the desired VOR and use the course-selector knob to set the head of the course arrow to the appropriate omni-bearing. Then turn the heading selector *(Continued on page 57)*



INSTRUCTOR *sets up a problem for navigation-bombardier trainee from his control console which contains all the flight controls, instruments necessary to "fly" simplane*

AIR FORCE *trainee works out a problem from one of several booths which enable multiple training of air-crew personnel. Radar trainer familiarizes crews with flight problems*



SIMPLANE *travels forward, sideward, up and down on rails, over water tank to simulate plane's flight. Suspended from simplane and submerged in water is a radar scanner which transmits ultrasonic waves to terrain contour map*

Radar Trainer

Air Force develops a complex radar ground trainer to teach its navigators, bombardiers how to read the radarscopes accurately

By E. H. Forbes

The first time you saw the picture that appears on a radarscope you probably wondered how a radar operator ever learns to interpret those weird globs of light. It's one thing to learn the general principles on which radar operates. It's quite a different thing to learn how to use the valuable information it conveys.

So tricky, in fact, is the job of differentiating the nuances of light on a radarscope that an extremely complex radar ground trainer has been developed by the Air Force to teach its navigators and bombardiers how to read their scopes accurately. Designed and built by the Electronics Division of American Machine & Foundry Company, this trainer can duplicate on the ground the same radar signals that would be received on any military mission, so that the picture on its radarscope looks exactly as the picture on an airborne scope would look over any given area in any given conditions. Up to now there has been only one way to practice flying by radar, and that's been to take trainees up in planes and devote many hours of expensive flying time to each potential expert. Even so, there has been no accurate way of checking how much each trainee has learned through this laborious method. Nor has there been any way of briefing experienced personnel on the radar readings they will receive over enemy territory. This new radar trainer does all that, and quite a lot more.

What makes the new trainer work is one of those odd facts of physics. Ultrasonic waves, *i.e.*, sound waves above the limit of human audibility, travel through water at a speed which has a very definite ratio to the speed of electromagnetic radar waves in air. That ratio is just about 1 to 200.000. Taking advantage of this fact, AMF reduced all the elements involved in navigating by radar to the same scale.

The region to be "flown" *(Continued on page 52)*

by Ralph Romaine
Chief Test Pilot, The Edo Corporation

Flying the Hydro-Ski

A test pilot details operation of hydro-skis and how they extend rough-water operation of hull-type seaplanes, add utility to landplanes

Things were getting pretty slow, flight-test wise, back in 1947 at the Edo Corporation when Bill Ryan, V-P Engineering, returned from a visit to the NACA seaplane-towing basin at Langley Field, Virginia.

"We really fixed you this time!" he announced and then went on to describe what appeared to me to be a very wild-eyed plan to install a couple of skis, suspended four feet below the keel, on a Grumman *Goose* to fly off the water! The fact that it was also to fly from snow, ice and sod surfaces was not nearly as alarming since that already had been done many times, but skis under a seaplane for water flying seemed a little out of place even though water skiing behind speed boats was fast becoming a major sport.

Actually, it's these new development ideas that make the flight-testing game particularly interesting to the pilot. You get your biggest kicks out of doing things for the first time or at least early in the game.

So it was with the hydro-ski project. The whole thing has never appeared to even its most ardent proponents as revolutionary as jet propulsion, but to me there has been every bit as much kick and gratification out of its development as there was from my flight test work with the Navy's first jet airplane, the McDonnell XFD-1.

Like any new and radical flying idea, the wild-eyedness subsides into practicability once you start engrossing yourself in the engineering soundness of the thing. Take a trip down to the NACA and talk to hydrodynamic experts like Jack Parkinson and his able staff of associates—Jack Dawson, Ken Wadlin, Norman Land, Jack Ramsen, to mention a few—and you are ready to believe. Settle these initial and enthusiastic reactions with the Bureau of Aeronautics' long-time hydrodynamic expert, Fred Locke and the extensively experienced, Charles Daniels, and you're raring to go. Follow the design thoroughness of Edo's Chief Mechanical Engineer, Cy Fenn, assisted by the theoretical analysis of Dr. Pepper and you're chafing at the bit. You're no longer surprised six months later when you roll down the Edo ramp into the East River, taxi a bit, shove open the throttles and come roaring to the surface supported on a hydro-ski by a four-foot Pogo stick. You've got some learning to do as you go along because there are no books to read or flight-test reports to digest; you're doing it for the first time!

The hydro-ski development during its first year or so was unique in one way—everything worked the way it was designed to work. It's all too rare that you take a leap this big and meet with so much success. It's an established fact that to combine a seaplane and a landplane into a single airplane, an amphibian, you make compromises and end up with something a little less than either a seaplane or a landplane designed for the same task would have produced. The original JRF-5 hydro-ski airplane actually bettered seaplane performance significantly while producing a snow, ice and slippery sod capability never before achieved with any airplane,

TEST PILOT *Ralph Romaine (center) discusses hydro-ski flying with Convair's Ernie Stout (right) and Chief Test Pilot Sam Shannon, who test flew hydro-ski-equipped Sea-Dart*

and that has always seemed amazing to me.

The first apprehension you have about flying a hydro-ski airplane and the first question you are asked by someone being initially introduced to the configuration are the same. "Does it want to stub its toe?" Take a look at the picture of the JRF flying off the water with the relatively small planing surface disposed four feet below the keel, and you're almost certain that it would. Hydrodynamicists can relegate such a query to an inconsequential role as neatly as I used to hear aerodynamicists wish off aileron or rudder reversal. The ultimate outcome often makes you suspicious. With the ski trimming down and stubbing its toe, however, the experts' explanations have been borne out.

It's fairly well established that a hull or float plane landed at too low a trim and too hot will trim down rapidly with what often develops into an uncontrollable force, then over you go—usually for the last time. The same is true of hydro-skis. Low-trim, hot landings in all likelihood will produce the same results. With due respect to stable trim limits of stability, however, you can fly a hydro-ski with the same freedom you enjoy with seaplanes. The actual minimum angle of attack that is safe to plane the ski during take-off and landing is a function of c.g., flap setting and water speed, as is the case with conventional seaplanes.

While flying as observer in the first JRF hydro-ski airplane at Patuxent, I watched Cdr. McNeely, Senior Project Officer of the Patrol Plane Flight Test Section, take the airplane down to 0° trim of the forebody keel. The ski, being attached at a 2° positive angle to the forebody keel, was running 2° positive. I cite this only to give an example of the ability to run at low trims. Actually, good hull design also will permit very low trims. A 20° deadrise alternate hull bottom on a modified J4F-2 *Widgeon* research seaplane has been run to -2° trim of the forebody keel during take-off without loss of control.

At speeds below take-off, negative ski trim has been applied at least once without catastrophic results. While I was check riding with another pilot, the control yoke was inadvertently slammed full forward while planing at about 45 knots. The airplane trimmed down *(Continued on page 48)*

HYDRO-SKIS *installed on Grumman Goose enable the aircraft to take off and land on snow and ice as well as water. Continuing tests are being run on this ski installation*

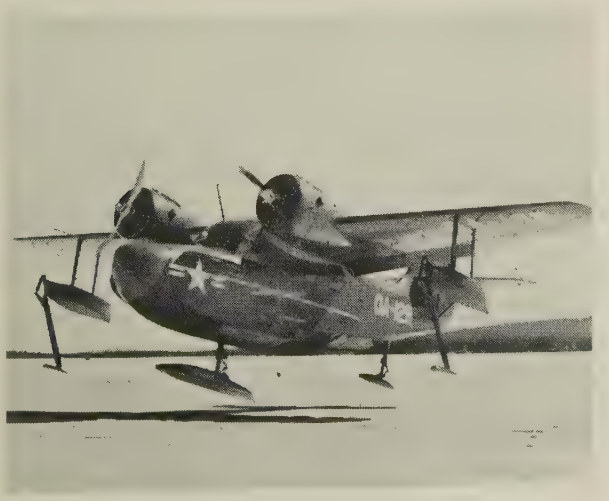


PHOTO-SERIES *shows the Grumman Goose with new double hydro-ski configuration developed by Edo Corporation under U.S. Navy contract. At comparatively low speeds, the lift of the hydro-skis permits the airplane to leap out of the water at very low speed, eliminating any planing run. Double hydro-ski configuration shown here is similar to that being tested on Convair XF-2-Y (front cover), water-based jet plane*

By Paul E. Pritzlaff
Chief Flight Instructor, Pan American World Airways, Atlantic Division

A Report on DME

Tests indicate DME meets accuracy required for enroute navigation, terminal traffic control and possibly final approach

Early in 1948, an instrument was installed in one of our training planes and we were told that by looking at this instrument we could read, in flight, how far we were from an antenna mounted on the Hazeltine Electronics grounds on Long Island. After making the appropriate number of wisecracks about it, we went out, tried it, and on numerous training flights found the results very acceptable. This unit was then removed from our aircraft for further study, modification and improvement, and standardized DME specifications were developed to fit a common civil-military program.

Distance Measuring Equipment, or DME, consists of both ground and airborne units, and is similar in operation to the IFF Identification System installed in our planes during World War II. The airborne equipment, or interrogator, radiates a series of pulses. These pulses are received at a ground station which is "triggered" and the ground station, or transponder, sends a reply back to the airplane. The very small amount of elapsed time between the original transmission from the airplane and the receiving back of the ground signal is then used to give us a measure, on a dial or indicator in the cockpit, of the slant distance between the aircraft and the ground station. Selection of any one of the possible 100 DME channel frequencies is accomplished by means of a direct-reading frequency selector in the cockpit. In the majority of installations this will be the same frequency selector used to operate the VOR receiver. Hence, whenever the frequency of a VOR station or ILS station is selected, the DME interrogator will be tuned automatically to its proper channel.

After 1948, my next contact with DME was in the summer of 1952, when the improved DME units were installed in our DC-3 trainer for test and evaluation. Since '48, we have seen the omnirange (VOR) move rapidly to the forefront as an important part of aircraft navigation and, therefore, in these recent evaluation flights we were able to use Distance Measuring Equipment in conjunction with VOR as well as an adjunct to the ILS.

At the present time, we have two separate types of DME installed in our DC-3 training aircraft. One is the Federal Model "DIA" Interrogator and the other is the Bendix NA-5 (Hazeltine Model #1800 "DID" type). The only external evidence that the aircraft is equipped with DME is a small antenna of two possible types at the present time. One is a plexiglas cylinder one and a half inches in diameter, protruding approximately four inches from the fuselage. The other is a half-wave diamond-shaped antenna, the size and shape of your hand with the fingers extended, protruding approximately five inches from the fuselage.

On the instrument panel in the cockpit, there are three proposed-type indicators (Fig. 1.).

Indicator A consists of a rotating hand indicating the unit miles and the window showing 10's.

Indicator B is a Veeder Root type of indicator, similar to the speedometer on your automobile.

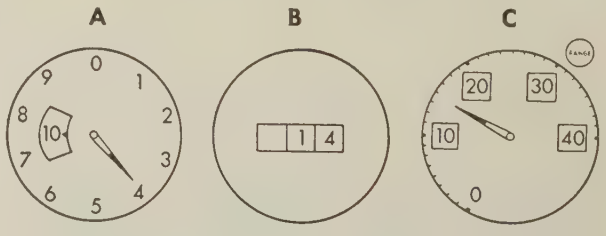


FIG. 1

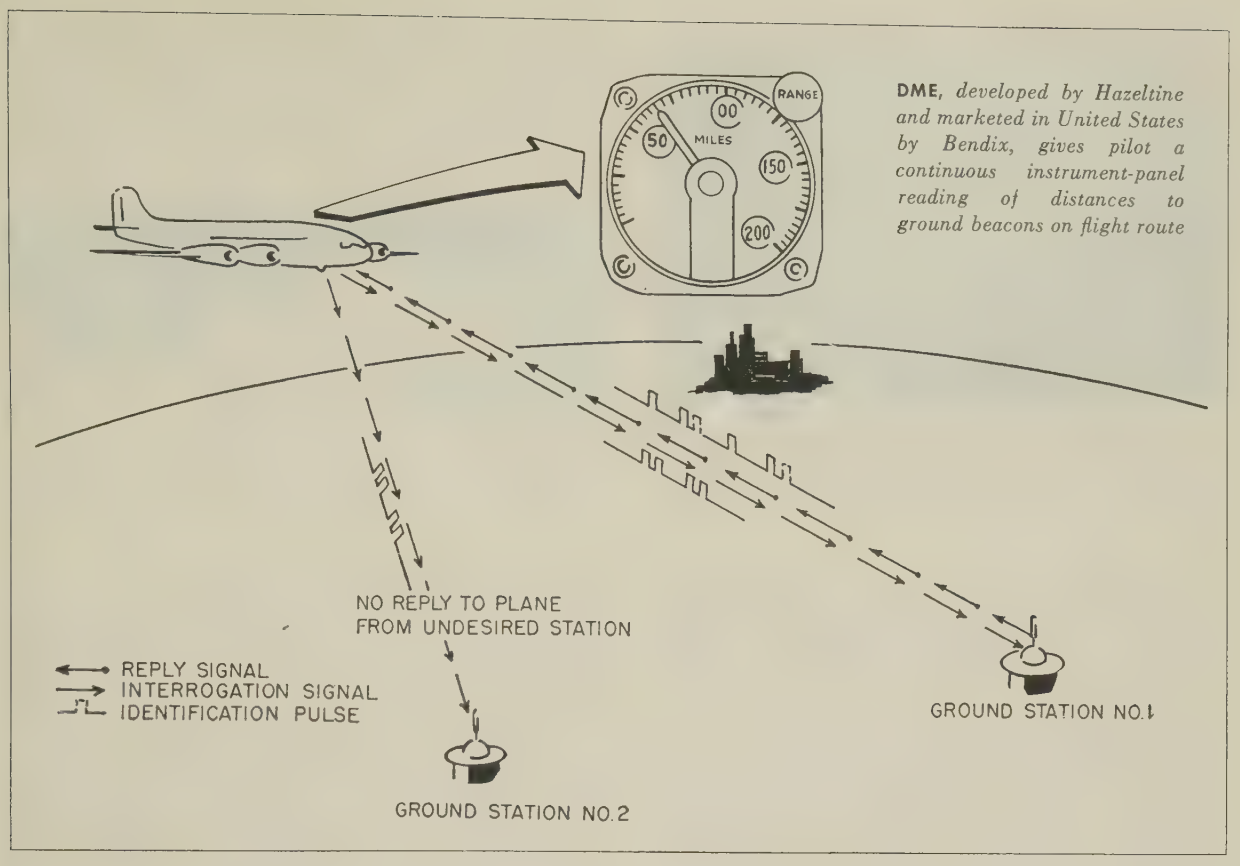
Indicator C is a voltmeter type indicator calbrated directly in miles and having two scales which may be selected manually by the pilot. One, 0 - 40 miles; and the other, 0 - 200 miles.

In the evaluation of the Distance Measuring Equipment, I was interested mainly in three phases:—

1) The accuracy of the equipment; 2) The method of presentation of the distance information; and 3) The operational use of such equipment.

Accuracy of the Equipment

To test the accuracy of the equipment, we made a



DME, *developed by Hazeltine and marketed in United States by Bendix, gives pilot a continuous instrument-panel reading of distances to ground beacons on flight route*

series of flights over charted paths recording the distance as shown by the DME Indicator when over various "fixes" and then later compared this distance against a measured chart distance. Fig. 2 shows an example of one of our test flights with samples of the results obtained.

We took off from Idlewild Airport and climbed to an altitude of 2500 feet. After turning the equipment on and checking its operation, we proceeded to the Flatbush Holding Pattern, which is on the southwest course of LaGuardia. The DME at this time was tuned into LaGuardia and we proceeded to make a standard ILS approach on LaGuardia. We then pulled up and proceeded on course to overhead Wilton Omni Range Station recording the indicated distances over various "fixes" enroute. From the Wilton Range Station, we proceeded south over the Connecticut shore line and the north shore of Long Island, to a point overhead of Jones Beach Tower on the south shore of Long Island. Holding over this point, we proceeded to obtain readings on the Poughkeepsie, Wilton, LaGuardia and MacArthur Field DME.

The results that I have seen indicate that the Distance Measuring Equipment of the various manufacturers is well within the generally accepted accuracy of five-tenths of a nautical mile or 3%, whichever is greater. As a matter of fact, as closely as I can observe, it is my belief that the equipment is operating in the neighborhood of plus or minus

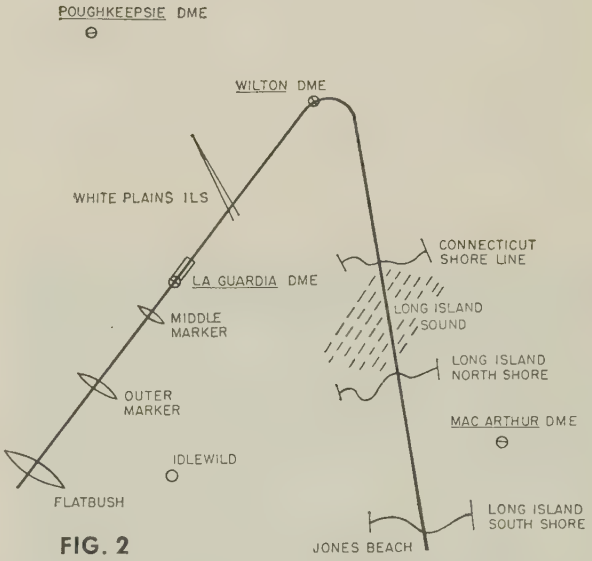
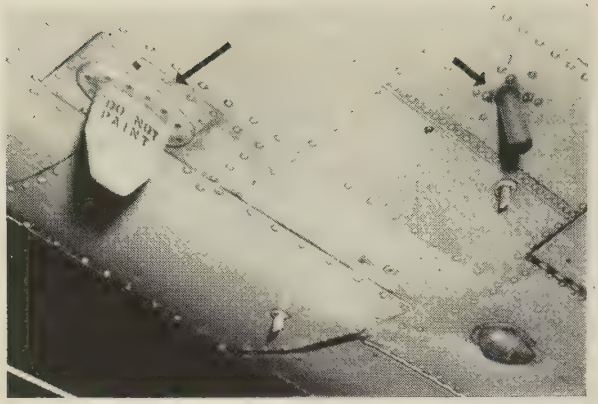


FIG. 2

DME Facility	Check Point	Altitude	DME Distance	Chart Distance
LaGuardia	Flatbush	1500	10.0	10.4
LaGuardia	Outer Marker	1300	4.0	4.0
LaGuardia	Middle Marker	250	0.5	0.8
Wilton	White Plains	2600	16.0	16.2
Poughkeepsie	Wilton	2500	32.0	31.5
Wilton	Conn. Shore Line	2500	11.9	10.9
Wilton	No. Shore L.I.	2500	18.0	18.2
MacArthur	Outer Marker	1500	5.4	5.22
MacArthur	Middle Marker	300	1.0	.78



DME ANTENNA *can be one of two types. One is plexiglas cylinder protruding four inches from fuselage (right arrow); other is half-wave diamond-shaped antenna (left)*

DME GROUND STATION, *located near Baltimore's Friendship Airport, is one of 450 stations eventually to be put into operation by CAA at airport sites and along air routes*

two- to three-tenths of a mile. This is about as close as you can read the DME Indicators or establish your position over any given fix.

Method of Presentation of Distance Info.

As indicated previously, there are three proposed types of indicators. Personally, I feel that the Veeder Root type is more applicable to use in the cockpit, inasmuch as the unit presents a direct reading and does not require interpolation on the part of the pilots. It is of the utmost importance that serious consideration be given to the simplification of any unit installed on the instrument panel to aid in elimination of cockpit confusion. It is interesting to note that the Distance Measuring Equipment can be designed so that it would automatically illuminate a light or a series of lights, at any desired preset distance from the DME station. In Fig. 3, as sketched, is my idea of a possible DME Indicator and its use at an airport in some remote area of the world, such as those airports served by Pan American World Airways.

The Indicator is of the Veeder Root type showing the nautical miles from the station. On the right-hand side of the instrument, starting at the top, is a runway with a red light underneath. Directly below that is a one-mile amber light, a four-mile amber light, and an "in-range" amber light in that order.

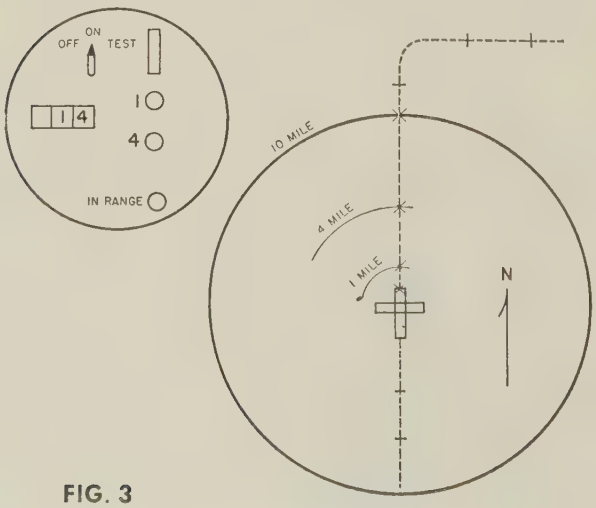


FIG. 3

At the airport shown in Fig. 3, there is a VOR/DME station located at the intersection of runways 18-36 and 9-27. Our approach this day will be to runway 18. We select 180 on our Omni Bearing Selector and intercept our course north of the field. When we approach the 10-mile circle the "in-range" light comes on and our chart shows us we may descend to a certain altitude. When we approach the four-mile circle, the four-mile light comes on and our chart shows us we may descend to an approved altitude. When we approach the one-mile circle, our chart will indicate we may descend to our minimum altitude. When approaching the threshold of the field, the red light will come on and, not being contact, we immediately execute a missed approach procedure. When we pull out to the south, the red light will go out, the one-mile light will go out, the four-mile light will go out, and the "in-range" light will also go out if we proceed more than 10 miles from the field. It might be possible that we are authorized to make a procedure turn at a certain minimum altitude within 10 miles of the field. In that case, we would make our turn while the "in-range" light is on and come back for another approach.

It will be noted that the only ground equipment required for this type approach which would allow us to make approaches to any runway on the field, would be the VOR/DME station at the field itself. Having a station on the field at these remote districts would greatly aid in maintenance, installations, elimination of pilferage, and damage of units located remotely from the field.

Operational Use of Equipment

Once having a piece of equipment such as the DME which has proven *(Continued on page 58)*

First of a series of articles that detail development of the Common System, its elements and how to use the Common System

THE AIR TRAFFIC STORY

No. 1: The Common System

Editor's note: Recently, the Radio Technical Commission for Aeronautics brought out a book entitled, "The Air Traffic Story." That organization's primary objective in the preparation of this material was to acquaint as many people as possible with the Common System of Air Navigation, Traffic Control, and Communication. SKYWAYS joins with RTCA in bringing this excellent material to the attention of those in aviation and, beginning with this issue, will feature "The Air Traffic Story" in installments covering The Common System, Elements of the Common System—Transition Period, and How to Use the Common System, Terminology, etc.

The story is being published in connection with the observance of the 50th anniversary of powered flight. The history of the development and use of the airplane is well known, but the important role played by electronics is unfamiliar to many. Therefore, SKYWAYS undertakes the publication of "The Air Traffic Story" as a service to its readers.

The Common System of Air Navigation, Communication, and Traffic Control was born, in 1947, out of a common necessity, military and civil. Military and civil needs go hand in hand, since military airlift operations, movement of bombing groups within the United States, training missions, and logistic operations are conducted in the same airspace used by civil aviation. There is only one airspace, and conflicting civil and military aerial highways in that space cannot be tolerated.

The airways were, and must continue to be, used in common by airline pilots, non-scheduled operators, personal flyers, and military pilots (the Common System is not designed to serve military operations of a purely tactical nature). With the volume of this common air traffic ever increasing and aircraft moving at higher speeds, there was the necessity to improve the airway and air traffic control system so that it would be capable of handling this increased traffic volume with efficiency and without compromising safety.

The problem and the needs were as old as aviation.

From the moment in 1783 when Jean Jacques Pilatre de Rozier became the first airborne human on a free flight, and immediately faced the choice of letting his balloon catch fire or crash into Parisian housetops, safe movement in the air has been a major headache. It became double migraine when more modern pioneers, armed with powered craft, strove to add frequency of flight to the safety factor. And its improvement—if not solution—came with the development of the aircraft to the point where it had economic, social, *(Continued on page 54)*

CAA *uses radar for long-range traffic control. Plastic pointers are moved to follow track of each plane*

Profit Opportunities in Servicing

Discussion lists prompt service, quality maint

able lounge quarters, public address system, au

WILEY R. WRIGHT, Director, General Aviation Staff, CAA, served as Moderator of the discussion. Mr. Wright served as AF representative in Los Angeles area for Materiel Command during World War II. In 1949 he became Director, Office of Aviation Development, Civil Aeronautics Administration, Washington, D.C.

Chairman Wiley R. Wright *(Director, General Aviation Staff, CAA):* "In considering the subject of this Round Table, 'Profit Opportunities in Servicing Business Aircraft', I'm sure we all agree to its value to both the aircraft operator and the service operator. Thinking of profit opportunities usually brings to mind some particular business organization that is outstanding in its service and financial capacity; and it often brings up the question, 'How did they reach that goal?' We in aviation have been and always will be particularly interested in giving outstanding service. Perhaps sales psychology is a part of that.

"If I may digress for a moment. . . . I was living in Seattle, Washington, about 20 years ago when my son was born. Up until that time I had been driving a roadster. Winter in the Pacific Northwest can sometimes be pretty rainy and chilly, and for the benefit of my wife and new son I decided to buy a closed automobile.

I knew the make and model I wanted and so, before my wife and son came home from the hospital, I went down to this particular agency. I walked into the showroom, looked over the model very carefully, opened the door and got in, sat down, looked over the instrument panel, got out and then climbed into the back seat. In a few minutes I got out of the car, walked around it again, looking at it from the front and the back, then turned to see where the sales people were. Three of them were there, but they paid no attention to me. I got back into the car, sat a bit—then got mad. Not until I started out the door of the salesroom did anyone say a word. One of the fellows called over, 'Anything I can do for you?' I answered, 'Not now, you've lost your opportunity. I made up my mind last week that this car

PARTICIPANTS *at Kansas City Round Table included (left to right around table) Ralph Piper, Monsanto; R. P. Washburn, Southern Flight Service; V. Hackett, Executive Aircraft Co.; Cole Morrow, CAOA; L. R. Inwood, City of Philadelphia; Jean DuBuque, CAOA; James B. Redwine, and Moderator Wiley R. Wright, CAA (sitting with back to camera is Bennett Horchler of SKYWAYS). This meeting was held at Hotel Muehlebach during the Congress of Civil Aviation*

Business Aircraft

ance, clean restaurant serving good food, comfort-

ental, Skytel facilities as profit opportunities

was the one I wanted to buy, and I came here with cash in my pocket. But because of the service you rendered, I'm going down the street and buy another automobile!' I guess you could call that one form of sales psychology.

"To start things off here, I'd like Ralph Piper, Chief Pilot of Monsanto Chemical Company, to give us his ideas in connection with efficient ground servicing of business aircraft."

Ralph E. Piper *(Chief Pilot, Monsanto Chemical Co.):* "There are different types of business-aircraft operations, some single-engine and some larger. We happen to be a company operating the larger DC-3 type aircraft and the Beechcraft, so we buy quite a bit of gasoline and require quite a bit of service.

"We set up our operation on the basis of giving service to the executives we carry. We try to have everything in the cabin at the passenger's fingertips . . . . everything clean. . . . everything comfortable; and the only thing we expect when we land is that the service on the ground be commensurate with what we try to give in the air.

"If we have a load of customers aboard, those customers are going to have a much better impression of our company and the people we do business with if they are met on the ramp by the front man for that organization—not a mechanic or a line boy but someone who is well dressed or at least wearing a clean uniform. Right away that creates a good impression, both for our company and for the company selling us service.

"After he's brought his passengers in, the next thing the pilot thinks about is efficient and thorough service for his aircraft. It is to the best interests of both parties, the aircraft operator and the service operator, to have the service situation set up so that the aircraft can be refueled, parked and cleaned. No pilot likes to go into town to a hotel and think about a dirty airplane sitting out there all night, and with a trip coming up the next day.

"We've found a few places that make refueling, parking and cleaning a plane a habit. In many places, however, we have to ask for it; and at some places they make that service available at a price and then sometimes let the whole service deal go

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

AUGUST, 1953

Hotel Muehlebach

Kansas City, Mo.

Round Table Participants

RICHARD P. WASHBURN, President of Southern Flight Service, Charlotte, N.C., served as flight, ground instructor for Southern Airways in 1946; became Manager of Charlotte branch in '47; in 1949 he purchased the Charlotte operation from Southern Airways.

LOUIS R. INWOOD was named Director of Aviation, City of Philadelphia, in April, 1953. He is a member of Civil Aviation Advisory Committee in Civil Defense Dept., Washington, D.C., and ex-President of Airport Operators Council, is presently a Director.

VIRGIL W. HACKETT, President of Executive Aircraft Co., Kansas City, was associated with Cessna Aircraft for 12 years prior to his organizing Executive Aircraft Co. He is an Engineering graduate of Kansas University and a native of Kansas City, Mo.

JAMES B. REDWINE began flying in 1927 and has been active in aviation ever since. He flew with the Air Transport Command during World War II, and has since flown over 5,000 hours as an executive pilot. He is member of QB's and Veteran Air Pilots Assn.

COLE H. MORROW is Chief Plant Engineer for J. I. Case Co. and Chairman, Board of Directors of CAOA. He is a member of the Executive Committee of RTCA, member of Industry Advisory Committee of Air Coordinating Comm., as well as many technical societies.

JEAN H. DUBUQUE, Executive Director of Corporation Aircraft Owners Association, has held key positions with airlines and Federal and State governments during his more than 20 years in aviation. He is a member of IAS, the Air Reserve Assn., QB's, etc.

RALPH E. PIPER, Chief Pilot of Monsanto Chemical Co., flew the Hump in C-87's and C-54's during the war. He joined Monsanto after the war when that company purchased its first airplane, a Beech D18S. He is now flying a DC-3; has flown it 4,000 hours since '47.

until morning, oftentimes too late in the A.M.

"We are always very much impressed by the service operator who offers us a check list of all the things we want done on the aircraft. All we have to do is to check each item, and when we leave we do so with a feeling of assurance that the plane will be ready for an early take-off the next day. No one is going to be embarrassed when the passengers arrive and find things half done.

"I think that both general and line servicing of aircraft throughout the country are getting better. There is a great deal of competition today, and the people who cannot meet the demands or requests of the business-aircraft contingent are putting themselves out of business."

Wiley R. Wright: "*Mr. Piper, you mentioned that you'd like to have someone come out to meet the aircraft upon its arrival. How do you let these people know that you are coming or that you are going to need that particular service organization? How can they meet you if they don't know you're coming?*"

Ralph E. Piper: "Usually, most of the alert organizations have a radio receiver in their office and they hear us report the aircraft number and type when we contact the tower. An alert operator will be out there waiting for that particular aircraft when it touches ground and he'll signal it to his ramp. Or, if you're in the habit of going someplace else, you go on down to the next stopping point, and there'll be a man there to lead you in for parking."

Richard R. Washburn *(Pres., Southern Flight Service Inc.):* "I'd like to point out to the corporate owners that a fixed-base operator is purely an economical unit, and any service he gives must be considered in the economic light of his organization. We have tried for a long time to give the type of service described by Mr. Piper and I think we have been reasonably successful. On the other hand, remember that we have a profit margin of only a few cents per gallon of gasoline sold. Also, many of the people with larger airplanes have found that we do not have the storage space that permits us to hangar their airplanes at night. You probably find that all over the country, don't you, Mr. Piper?"

Ralph E. Piper: "That's very true."

Richard R. Washburn: "Therefore, the only profit available to the operator is the amount of gasoline sold to that airplane. For that small amount of money, the operator is supposed to be able to clean the airplane, to have a man on the front, to have competent servicemen in uniform, and to offer all the other services a business-plane operator would like to have. From purely a dollar and cents standpoint, it isn't possible."

Ralph E. Piper: "The business-aircraft owner expects each operator to be able to make a reasonable profit. We feel that if our demands are beyond the reasonable level, we don't mind paying for that service, provided it's good. We'd be more than glad to pay for line servicing and cleaning the airplane, and we've offered it many times. The only time we aren't satisfied is when we purchase 500 or 600 gallons of gas and get no cleaning or servicing at all. There's a pretty decent profit in that amount of gasoline. If we didn't buy any gas, we wouldn't ask any operator to clean up the interior of our airplane for nothing. We'd be more than glad to pay for that service at an hourly rate or however they want to do it, just so long as its done well. We want results and will pay for it."

"**MAJORITY** *of pilots that stop at CAOA headquarters," stated Jean DuBuque (left, next to Jim Redwine), "complain about the poor service, inadequate maintenance at most airports"*

Richard R. Washburn: "Five hundred or 600 gallons of gas is an unusual fill in any fixed-base operation, but even that amount gives a gross profit of only $25.00 and out of this, the operator pays for labor, equipment, rental, inventory, losses, gasoline, and electricity to pump the fuel, plus all overhead costs of his operation. There are a large number of big aircraft flying for business in this country, but there are also a large number of fixed-base operators, and there are very few of those aircraft that are continually brought to one operator over a long period of time.

"We at Southern feel that we are in the middle bracket of fixed-base operators in that we pump around 20 or 25 thousand gallons of gas a month, and we have an average profit of 5 or 6 cents a gallon. You can easily see that that doesn't allow anyone to offer the kind of service the business-aircraft owner is justifiably demanding.

"One biggest problem—and we all have it—is competent personnel. The average serviceman earns anywhere from $150 to $225 a month. For that kind of money you aren't going to get the type of personnel that Mr. Piper is talking about.

"The average corporation pilot earns from $500 to $1,000 a month. He is interested in his job; he'll keep the airplane clean; and he'll have everything

PRE-ROUND TABLE *confab brought Virgil Hackett (left) and W. F. Conradt (center), one of the meeting observers, together with Wiley R. Wright for discussion of service problems*

SKYTEL *facilities at airports, an idea developed by SKYWAYS a few years ago, was recommended by Cole Morrow as way to draw business to airport. L. Inwood (right) agreed*

on board that the executive passenger needs or wants. But this line boy who averages $160 or $170 a month doesn't have the interest or, for that kind of money, the incentive to develop the interest that the pilot has in his job."

Virgil W. Hackett *(Pres., Executive Aircraft Co.):* "Dick, where do you get line boys for $160 a month? We're paying $230 minimum. My second question is in regard to that 5 cents a gallon: that's not your net profit, is it? Aren't you talking in terms of gross, and then you have to pay salaries and everything else after that?"

Richard R. Washburn: "That's right. On 20,000 gallons a month, we have a gross profit of roughly $1,000. If you have 18-hour service seven days a week, your gas sales won't even pay the salaries of five men to furnish that 18-hour schedule."

Wiley R. Wright: *"It might be interesting to know the number of business aircraft being used. Jean DuBuque, will you answer that for the record?"*

Jean DuBuque *(Exec. Dir., CAOA):* "At the present time there are approximately 10,000 business aircraft, and of that number over 1800 are multi-engine types. Business flying is rapidly increasing. In fact, it has practically quadrupled since 1945. Today, about $200,000,000 is invested in corporation aviation activities, and these organizations spend over $175,000,000 a year in operating and maintaining their aircraft."

Wiley R. Wright: *"There are more multi-engine aircraft in that type of operation than all the scheduled airlines combined. In view of that, it appears there is a tremendous business potential. Are there any other ways a service organization can develop a sales technique to cover more than just the sale of gasoline?"*

Richard R. Washburn: "We've tried to adopt the ideal situation described by Mr. Piper. We hand the pilot a check list and all he has to do is check the service items he wants and then he signs his name and his aircraft number. We even maintain a hotel room downtown, so they don't have to go to the trouble of making hotel reservations. The pilot checks into the hotel directly from our office. However, we've found that from the presentation of a thousand cards, not even a hundred people will take the time to fill them out for us. A lot of the pilots say, 'This is just like all that government red tape. All I want you to do is fill 'er up with gas.'

"We do insist that those who remain overnight fill out a card. The personnel on duty at the time the airplane comes in are not the same ones on duty when the plane checks out in the morning, and we have to have some record of continuity to give any service at all.

"In a strictly service capacity, gasoline is about the only thing that can be developed in any volume to render any profit. Sure, you can make a service charge for cleaning an airplane, but from a strictly service standpoint, if you perform no maintenance and make no sales of other supplies, I don't know how you can develop any appreciable amount of revenue."

Louis R. Inwood *(Director of Aviation, Philadelphia):* "Do you charge for overnight storage or tie-down?"

Richard R. Washburn: "We make no charge for tie-down. The insurance carriers who write most of the insurance for fixed-base operators will not insure aircraft stored outside. Or if they will insure them, from a hangar-keepers liability standpoint, the premium is exorbitant and the fixed-base operator cannot afford it.

"If a service operator makes a tie-down charge to the aircraft owner, the service operator incurs the same liability for that aircraft as he would were it placed in his hangar. If a thunderstorm rolls through during the night and breaks up the man's airplane, the fixed-base operator is liable for it. We do not offer tie-down serv- *(Continued on page 38)*

by Harvey A. Senior

ELECTRIC FUEL PUMP for AIRCRAFT HEATERS

Airline use of Bendix electric fuel pumps for cabin heaters prove first-cost economy, long service life, and reliability of operation

Reliability has long been a watchword of the aviation industry. Simplicity plays an important part in achieving reliability by reason that, other factors being equal, the number of potential causes of trouble in a specified mechanism is directly proportional to the number of operating parts involved.

Accessory equipment manufacturers invest considerable quantities of money, time and effort in conceiving a solution to an expressed need, in building and rebuilding crude laboratory models which are subjected to all kinds of performance tests, and in perfecting details of design until the final article has been refined to the utmost degree. It is this final version that is placed in production and emerges to perform its designated function with the highest possible degree of reliability.

Every once in a while an enterprising design group will leave the beaten path of well-known principles and will strike out into untried fields in an attempt to achieve increased reliability and kindred qualities by application of lesser-known principles. One such refreshing change of pace has been achieved in the development of the Bendix electric fuel pump, designed and manufactured by the Eclipse Machine Division of the Bendix Aviation Corporation, Elmira, New York.

Use of gears, sliding vanes, diaphragms, and various styles of impellers are well known in the field of fuel-pump design, and are in general use. The long life and dependability of the Bendix electric fuel pump, however, are achieved by the combination of an age-old, time-proven pumping principle with a tamper-proof, hermetically sealed electrical system.

In 1946, work was started in the Eclipse engineering development laboratory, designing, building, and testing fuel pumps. The evolution of the final model started with very crude examples which were redesigned and refined until the present pump emerged. This pump has been tested under the most severe operating conditions. Accordingly, the manufacturer believes that these tests have proved this pump to be the best on the market today within its capacity range.

Construction

The Bendix electric fuel pump has been ruggedly constructed to give thousands of hours of trouble-free service. The accompanying photograph *(page 25)* of the pump interior shows the construction and identifies the various parts mentioned below.

The pump case is made of steel and is cylindrical in shape. A transverse mounting bracket attached at about the case midpoint permits attachment of the pump to structure by means of two bolts. The mounting bracket serves as the ground connection of the electrical circuit. All parts of the electrical circuit are tamper-proof and hermetically sealed in a helium atmosphere. An inlet connection near the bottom of the case directs fuel to an inlet chamber. All fuel entering the pump passes through a fine screen. A permanent magnet in the inlet chamber traps magnetic particles before they can enter the pump plunger.

The pump proper contains a hollow steel plunger freely fitted in a brass cylinder. The plunger has no gland or seal, instead the fuel itself provides a seal by filling the small clearance between the piston and cylinder. This principle permits the pump to maintain design pressure throughout its life. Valves are attached to the lower end of the plunger and to a spring cup which is fitted over the end of the brass cylinder. The valves operate in the manner of a common pitcher pump.

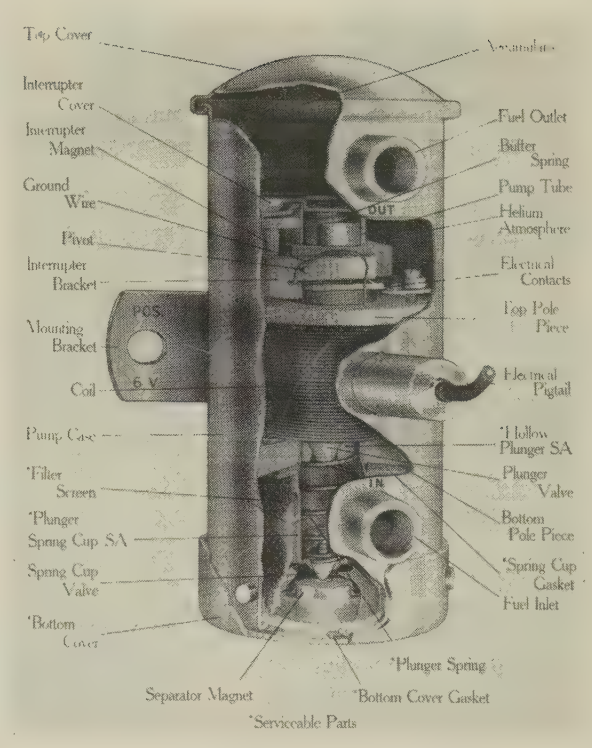
An ingenious electrical interrupter system controls the action of the pump. The interrupter system is composed of a permanent magnet mounted on a freely swinging bracket. On this bracket is

mounted a spring contact. The magnet senses the position of the plunger in the brass cylinder and causes the bracket to swing, thus closing the contacts when the plunger reaches the end of its stroke. When the contacts are closed, a coil of wire surrounding the cylinder is energized and the plunger is electro-magnetically drawn down to compress a plunger spring. This spring design governs the pump static pressure. As soon as the spring is compressed, the interrupter causes the electrical circuit to open. The plunger spring then pushes the plunger back up to its original position. It is on this upward stroke that both pumping and suction occur.

The fuel under pressure passes upward into an outlet chamber and thence to an outlet connection near the top of the pump case. An accumulator diaphragm at the top of the case is deflected under pressure and tends to smooth out pump discharge. The bottom cover attaches to the pump case by means of a bayonet lock and provides access to serviceable parts *(see photo, right)*.

The electrical terminal is made in two models. Military designs are equipped with radio suppression. The commercial version of the pump is provided with a length of well-insulated wire for easy connection. Both of these electrical connections are waterproof. Hermetic sealing of the section containing all electrical parts means that no one need make any adjustments in the electrical circuit after the pump leaves the factory. The helium atmosphere insures that no contamination of the contact points will occur and that long contact life may be expected.

Six basic models of the electric fuel pump are made. These are 6-volt, 12-volt, and 24-volt pumps operating with a positive ground, and 6-volt, 12 volt and 24 volts pumps operating with a negative ground. To these basic pumps, the following may be added: a standard or a stainless steel plunger,



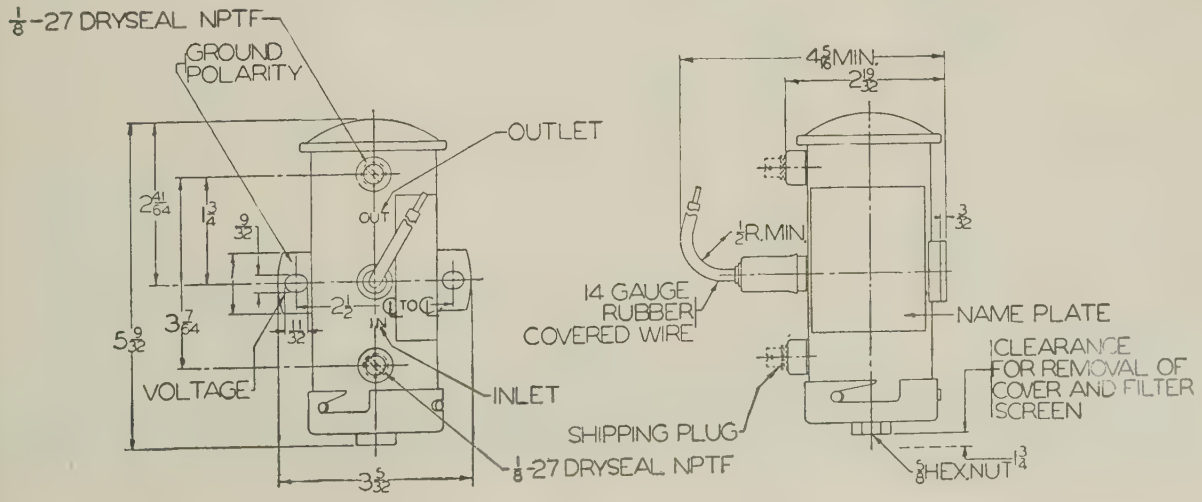
CUTAWAY *of electric fuel pump shows arrangement of parts. Bottom cover is removable; parts are accessible for service*

the correct plunger spring to give the pressure requested by the customer, radio suppression or a commercial pigtail lead, and finally the pump may be painted olive drab or may be cadmium plated, as the customer desires.

Operation

The Bendix electric fuel pump is unaffected by temperatures from -75° to well over 200°F. In addition, the pump has a very long life. The explosion hazard is eliminated by having the contact points hermetically sealed in the helium atmosphere. The light weight (1 lb., *(Continued on page 47)*

MOUNTING DIMENSIONS *and space requirements are shown in outline drawing of the electric fuel pump. Tubing for fuel lines is 5/16 or 3/8th inch O.D., depending upon fuel-delivery requirements and pump's general installation*



Performance

from the Files of the Flight Safety Foundati

TELEPHONE ADDRESS BOOK

Pilots flying the overseas segment of one large airline have found a new use for telephone address books—the kind where the cover springs up to the preselected letter when a tab is pressed.

On the cover, in place of the index letters, pilots paste the list of emergencies that call for immediate action but require a check list to be certain that no step is overlooked. For example:

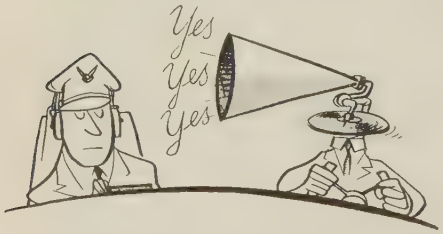
(Emergency) Engine overspeed
Propeller feather, unfeathering
Emergency Descent
Explosive Decompression

On the inside pages of the index, in the place where formerly a lonely pilot could seek solace in telephone numbers, are pasted the procedures in abbreviated form. When an emergency occurs, a quick and simple operation produces the desired check list. Press the tab, and there is the procedure.

This is much more efficient than searching for a page in a book or looking for a card. The pilots carry this simple gadget with them at all times.

ERROR BY HABIT

An air transport was approaching La-Guardia. The co-pilot was reading off the check list, and the captain was responding. Came time to check the undercarriage hydraulic pressure and in reply to the co-pilot's question the captain's response was "Down,

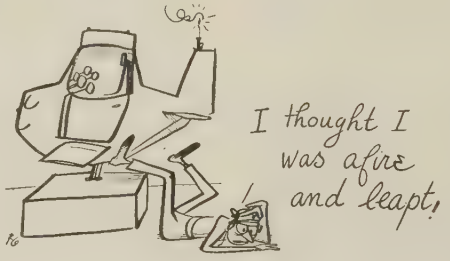


three lights, pressure up." The flight engineer was performing his usual duties but because of his interest in determining how a newly installed hydraulic gauge was operating, he glanced at it. Much to his amazement the pressure was zero.

He immediately called this to the attention of the captain who declared an emergency. The ship had to be towed off the runway after landing.

The interesting point here is that the captain was responding to the check list out of habit rather than by actually checking the instruments. This is a natural error to make after long, trouble-free operation of an airplane, especially in this case where the pressure gauges were partly hidden by the co-pilot's knees and by his control wheel.

To overcome this, psychologists suggest (1) that the sequence in the check list be changed occasionally and (2) that the captain be asked to read the actual figures on the gauges. The psychologists, however, admit that neither one of these is the complete solution to this rather serious problem.



DE-SCENT

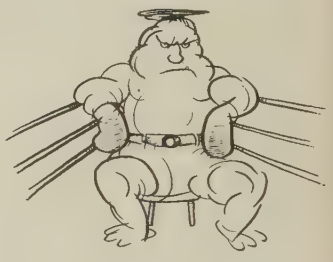
A pilot's nose can be a very sensitive detector of smoke (fire), smells (hazardous cargo leaking) and mechanical trouble (leaking fuel, hydraulic fluids, etc.). It is suggested that smells be introduced as part of the training in Links and Simulators, to keep crews alert to these clues to trouble or at least have representative samples around to train crews to recognize odors. Could save a lot of time in emergencies.

HEAVY STORM AREAS

The following is extracted from an airline's memorandum to its Ground and Operations Departments:

"The season for thunderstorms still continues. It is extremely important that all personnel and all departments involved in flight operation, line maintenance, maintenance engineering, and overhaul are conscious of this fact.

Everybody's cooperation needed▶ "
function of Dispatch and Meteorologist
regards thunderstorm operation, is of
importance inasmuch as the responsibilit
forecast, interpretation, and disseminatio
information of thunderstorm areas,
squalls, and potential tornado areas
with them. Of no lesser significance is
need for all flight officers to provide acc
inflight information to dispatch offices
other flights relative to their inflight
perience, location of known thundersl
activity, exact location of turbulence,
and lightning. Past history shows tha



practically every known accident du
operation in, around, or through thu
storm areas, the catastrophe might have
averted had existing information and/or
cast information been passed on, pro
analyzed and respected by all parties
cerned.

"The Line Maintenance, Engineering
Overhaul function in this period of t
lence is to assure the operation of e
ment required, to revitalize close inspe
of aircraft systems and structures, and
constantly aware of the hidden hazar
hail, ice, lightning, and turbulence dan

Review Cabin Management▶ "It is
gested that Transportation Services r
summer operating problems, emphas
again the necessity for all cabin attendar

respect the meaning of the "Fasten your
Belt" sign. We have only recently rep
two more serious cabin attendants' inj
In both instances the seat belt sign wa

PITFALLS

by Jerome Lederer and Robert Osborn

he cabin attendants had in one case been rewarned by the crew. Here again, the light Operations group can be helpful to oth cabin attendants and passengers by aking certain that adequate information is assed on relative to anticipated turbulence nd the extent of it, being doubly sure that moderate turbulence is expected the cabin ttendants are cautioned to *remain in their eats.*

Tell Others▶"Although the paragraph hat touches on Ground Services responsibilities is short, it covers a large scope of our ctivities. We must give consideration not nly to the care of equipment on the ground, ut should also alert our personnel at the ations who are involved with communications, dispatch responsibilities, weather observing, and the many other related activities or which our people are responsible.

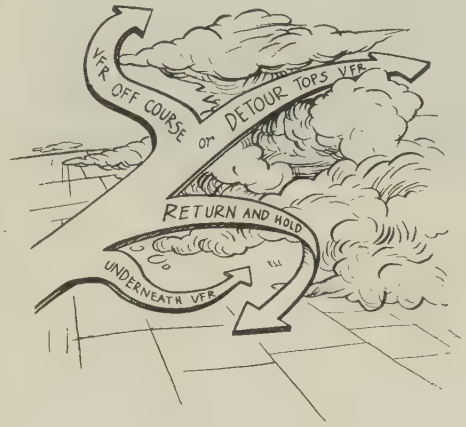
The Encounter▶"In the conduct of our perations, we must at all times give proper onsideration to the three factors which will ery obviously determine the extent of our uccess. In the order of importance, those actors are:

1. Safety
2. Comfort of passengers
3. Speed and regularity of schedule.

"In no case, should safety or comfort to assengers be sacrificed in favor of speed and egularity of schedules.

"There is nothing that terrifies our passengers quite as much as being flown *through* hunderstorms in which excessive "bumpiess" is encountered, coupled with the display of vivid lightning discharges. In the ast, I think we have on occasion sacrificed he comfort of our passengers, and possibly heir safety to some extent, by deliberately ying through thunderstorms which could ust as well have been avoided through slight etouring.

"Due to the very nature of thunderstorms (each thunderstorm situation requiring a separate analysis by the pilot), it is impossible to set down specific rules or regulations to be followed in handling such situations.



The potential dangers existing in thunderstorms are:

A. Squall wind near the surface
B. Intense and adjacent up and down drafts
C. Hail

"Because thunderstorms of different regions tend to have special characteristics and because of marked differences between storms, the potential dangers must be borne in mind and such dangers suspected until the contrary is proved by observation of the particular storm."

FLAG ALARMS

From a safety point of view, pilots can trust flag alarms too far. Flag alarms do a good job of warning the pilot that inadequate signals are present in the deviation indicator circuits, but they do not warn of:

1. Shorted or open deviation indicator circuits (false on-course condition).
2. Certain receiver failures which may displace localizer, glidescope, VAR or VOR on-course indications. Localizer and glideslope on-course indications may be displaced a fraction of a degree or several degrees: VAR as much as 5° or 15°, VOR as much as 30° or more without flags appearing.

These procedures are suggested to compensate for inadequacies of some flag alarms:

Enroute VOR (or VAR) operations using dual installations:

A. Prior to departure from blocks, check both receivers against same VOR to make certain the two receiving systems agree with accepted tolerances.

B. In flight, keep both systems tuned to same station and set same course as much of the time as practical and long enough to tie down each new course and establish crab angle required to hold each new course or radial.

C. After tying down crab angle needed to hold new course, switch one receiver to next course to be flown. As next course is approached, switch second receiver to this course and double check it. This is important when next course is at angle to course being flown and high terrain or conflicting traffic might be encountered if intersection of two courses is overshot due to inaccurate receiving system.

Enroute VOR operations; single installation:

A. Prior to departure from blocks, check receiver against VOR signal to make certain of its accuracy.

B. When flying high enough to receive next VOR when over a VOR or known fix, check accuracy of indications from next VOR against published or plotted omni-bearings on your chart.

C. When flying on course on one of two direct radials between two VOR's, switch to second VOR frequency half way between VOR's. Centering deviation indicator should give an OBS reading which does not differ from reciprocal of published second VOR radial by more than 4° or 5° if airborne equipment is okay. Reciprocal of second radial is used to eliminate need for correcting magnetic variation and for rotating OBS through 180° to check.

D. Double check VOR indications wherever possible by using ADF or LF range receiver.

Dual systems and proper operating procedures or cross-checking of single system will warn pilot of remaining system failures. Always use your tools wisely.

SKYWAYS FOR BUSINESS

FIRESTONE TIRE & RUBBER CO. *owns and operates a fleet of three aircraft for business purposes. One is a Twin-Beech, two are Lodestars (above) and each are flown 50 hours a month*

Port of N.Y. Authority Acts to Establish Bi-Directional Instrument Approach Systems

New York, N.Y. Action leading to the establishment of bi-directional instrument approach systems at N.Y. International, LaGuardia and Newark Airports to permit full utilization of the instrument runways, minimize circling in the airport areas and improve air traffic control and flow in instrument weather, will be undertaken by the Port of N.Y. Authority, according to a recent announcement. Such action contemplates the installation of approach lights and other necessary navigational aid facilities by the CAA in the near future.

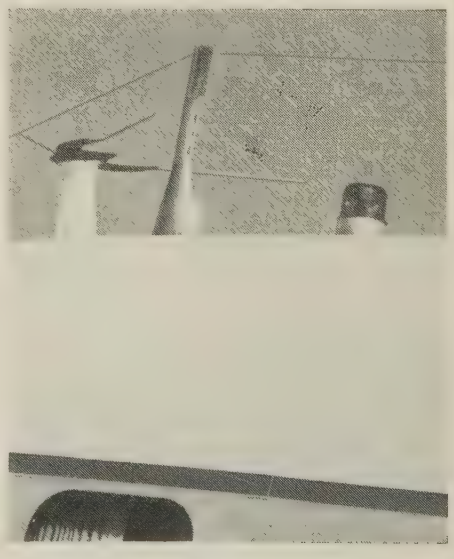
At the present time, the instrument runways at all three airports are equipped to handle approaches under instrument conditions from the southwest only. By equipping the instrument runways to permit approaches from the northeast and establishing necessary flight procedures, planes will be able to make landings from either of two directions, thus avoiding the circling necessary when approach is made from the southwest and the wind requires a landing from the opposite direction.

The Port of N.Y. Authority also announced adoption of a master runway plan for N.Y. International Airport which ultimately will provide a dual parallel runway system to make possible simultaneous landings and take-offs during instrument weather conditions. Under this plan, a new instrument runway will be built parallel to and 3,000 feet east of the existing Instrument Runway V (4-22). Both runways will be 8400 feet long.

When this new runway is completed and in use, existing Runways A and D will be secondary runways, and Inactive Runways E and F and the area previously reserved for future construction of Runway U will be converted to aeronautical activities other than landing and take-off of aircraft.

In cooperation with the CAA, the Port Authority is taking steps to implement bi-directional approaches at LaGuardia, thus making greater use of the northeast approach over water. This necessitates the provision of mountings for lights on piles in the over-water approach from the northeast to the Instrument Runway 4-22.

The contemplated implementation of bi-directional instrument approaches at Newark Airport will permit greater use of a northwest approach over the industrial area to the new Instrument Runway A (4-22) which the Port of N.Y. Authority recently built. Aircraft parking, apron and taxiway areas will have to be abandoned to permit the installation of the new approach lights for this runway at Newark Airport.



GRIMES LIGHT *(above, right) on Firestone Lodestar, is a rotating anti-collision beacon*

Firestone Lodestar Equipped with Grimes Rotating Beacon

New York, N. Y. A recent visitor at La Guardia Field was a Lockheed *Lodesta* owned and operated for business purposes b Firestone Tire & Rubber Company, Akron Ohio. Firestone has been an operator o business planes since 1928.

Feature of this *Lodestar* that commande the attention of other business pilots on th field was the installation of a Grimes Anti Collision Rotating beacon, mounted atop th forward part of the fuselage and just aft o the "Ram's Horn" antenna. This installatio was one of the first on executive aircraft, an Firestone's other two business planes, a sec ond *Lodestar* and a Twin-Beech, are havin similar Grimes Anti-Collision light installa tions made at the present time.

Lodestar N1831M is flown an average o 50 hours a month; it carries 10 passenger crew of two, and is equipped with ILS, Co lins 180-channel omni and other standar radio equipment. Merle Brown is pilot; Bi Ellis, copilot. Conversion work on this bus ness aircraft was done by Aerodex in Miam Florida, in 1948.

Firestone's first business aircraft was Ford Trimotor which was in use from 192 to 1930. This was followed by a Waco, later Ryan, a stagger-wing Beech and a Stinso and a Twin-Beech. Firestone's present fleet o aircraft consists of two *Lodestars* and Twin-Beech. Pilots are Tommy Herman, Bi Rians, Chick Pentecost, Merle Brown an Bill Ellis. All three crews have been checke out to handle any of the three Firestone ai craft. Walt Maki is Chief Mechanic in charg of all Firestone aircraft maintenance Akron, Ohio, home base for the Firesto fleet of business aircraft.

CREW *who flew Lodestar into LaGuard were Merle Brown (left), pilot, and Bill El*

Expands Sales Operation

rbank, Cal. Expansion of the Aviation ucts Sales departments of Pacific Air- ve is well underway following the recent to new plant facilities adjacent to 's home office. Located outside the pro- on area, the sales department's visitors nger have to obtain security clearance. ice space has been let to representatives G Corporation, Chandler-Evans, P&W aft and Pan American World Airways. ajor lines available from the new PAC headquarters in Burbank include Ben- Scintilla, Hamilton Standard, Champion, ard, Eclipse-Pioneer, B. F. Goodrich, & Whitney Aircraft, Bendix Products, lex, Exide, Auto-Lite, Aero-Seal, BG oration, Time-Rite, Chandler-Evans, tex Fabrics, Macwhyte, Sherwin Wil- , National Electronics, Jack & Heintz, , De Havilland and Bendix-Red Bank.

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th Carolina Issues Spraying, ding, Dusting Regulations

lumbia, S.C. The following regulations erning aerial spraying, dusting, seeding, were recently adopted by the South lina Aeronautics Commission:

It shall be unlawful for any person to an aircraft while engaged in aerial ing, dusting, seeding, or any other ar operation within the state unless that is the holder of a valid current permit l by the S.C. Aeronautics Commission gage in those operations.

e applicant for such a permit must hold rent Commercial Airman Certificate with nimum of 300 logged hours, 25 of which have been logged while engaged in l application. If the applicant does not ss the above mentioned qualifications, applicant must, in order to qualify for permit, receive a minimum of 25 hours r the direct supervision of an aerial ap- tor who holds an effective, current permit d by the SCAC, and the applicant must produce written evidence that he has ved the minimum 25 hours of aerial ex- nce. If the applicant received his 25 s minimum experience in aerial applica- outside the state of South Carolina, he produce documentary evidence which s the complete satisfaction of the SCAC. rmits for aerial spraying, dusting, etc., ssued beginning January 1 of each year, out charge to the applicant. This permit lid only for the calendar year in which d. Appropriate forms for an aerial ap- tor pilot permit are furnished by the Aeronautics Commission, Columbia, S.C.

No person piloting an aircraft shall en- in aerial spraying, dusting, seeding, etc., n the state unless the aircraft being used been properly registered by the South lina Aeronautics Commission. Forms for registration also are available from SCAC.

Prior to the issuance of a registration ficate by SCAC, the applicant must, un- oath, certify that the aircraft to be used spraying, dusting, seeding or any other ultural operation or pest control, is pped with approved type safety belt and lder harness, and the pilot must wear the oved safety belt and shoulder harness at imes during the dusting, seeding, etc.

....in the Business Hangar

Atlantic Refining Company's Twin-Beech has been in Temco's shop for installation of a Flite-Tronics MB-3 Marker Beacon receiver. Home base for Atlantic Refining is Dallas, Texas.

The H. K. Potter Company of Pittsburgh, Pa. recently bought an executive B-23. The business plane formerly was owned by Lehman Brothers, New York investment brokers, and it was sold to the Potter Co. by William C. Wold Associates, an aircraft sales firm, for $200,000.

Universal Trades, Inc. has had its *Lodestar* and *Widgeon* at Hawthorne Flying Service's maintenance hangar at Jacksonville, Florida, for engine change and acceptance checks.

O. C. Harper's de Havilland *Dove* is now equipped with a Flite-Tronics CA-1 audio distribution amplifier as well as an MB-3 Marker Beacon receiver. Riley Aircraft Service at Longview, Texas, made the installation. Mr. Harper's pilot is Harold Brasher.

Pilot Bob McDougal has Truesdale Construction Company's Twin-Beech back in the air after 100-hour check on aircraft and engines. The work was done by AiResearch Aviation Service at Los Angeles.

Also out of the shop at AiResearch Aviation Service and back in business operation is the Goodyear Tire & Rubber Company Twin-Beech. Earl Hartman and Paul McCabe, Goodyear pilot and copilot, had the plane in for 100-hour aircraft and engine check.

Howard Dubanowich, pilot of the Red Devil Tools' Twin-Beech, brought the company plane to Southwest Airmotive for a radio check. Home base for N 60716 is Irvington, N. J. A NBAA-member company, John L. Lee, sales manager and copilot of the Twin-Beech, is Red Devil Tools' NBAA (Formerly CAOA) representative.

Pilot A. Hinkle and his copilot, Frank Thera, stopped at Aerodex recently for a visit. They were on a business trip with Minnesota Mining & Manufacturing Company's executive DC-3, N 33M, which Aerodex converted for executive use several years ago. Three M's chief pilot, Don Richardson, is the company's NBAA representative, and home base of operations is Holman Field at St. Paul.

Durham Aircraft Service, Inc., of Woodside, N.Y. recently received its new full-coverage permits from the Civil Aeronautics Board. Durham's instrument and overhaul shops operate under CAB #3532.

At last report, Howard Peper, Chief Pilot for The Hubinger Company, had the company Aero *Commander* all set for a flight to Scotland, France, other parts of Europe and then England. President of the company and also a pilot, Robert S. Fisher planned to fly to England in time for the Coronation. Work on the *Commander* was done by Southwest Airmotive at Dallas. Home base for the *Commander* and The Hubinger Company's other business plane, a Beech *Bonanza,* is Keokuk, Iowa. Howard Peper is also his company's National Business Aircraft Association representative.

The Partlow Corporation's Twin-Beech is back in operation after a new three-color paint job. Work was done by AiResearch Aviation Service. The D18S was flown to the West Coast from its home port of New Hartford, N.Y. by its pilot, Wayne A. McGrew. A member of National Business Aircraft Association, the company representative is Howard W. Partlow, Jr.

Tom Rafeel, pilot of the Cantlay and Tanzola Twin-Beech, has the ship flying again after 100-hour aircraft and engine inspection by AiResearch.

Boots Jennings and his copilot, John Pancallo, are flying the Byron Jackson Company DC-3 after 100-hour aircraft and engine check by AiResearch Aviation Service. Boots is Chief Pilot and NBAA representative.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the members firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National headquarters are located at 1029 Vermont Ave., N. W. Washington 5, D.C. Phone: National 8-0804.

New Association Name Approved by Members

Members of CAOA overwhelmingly voted to change the name of the Association from Corporation Aircraft Owners Association to National Business Aircraft Association, during a Special Meeting held in June.

Board Chairman Cole Morrow in a letter to the members concerning the change of name said, "The present name of the Association is awkward and does not fairly describe the segment of the aviation industry represented by our membership."

"For some time," Mr. Morrow added, "a name change has been suggested by our members as well as others in government and the industry with whom the Association has dealings. Many names have been studied and we believe 'National Business Aircraft Association, Inc.,' is best suited. It is intended that this name refer to business concerns using their own aircraft, not those for hire, in carrying on their business functions. It does not include industrial, agricultural and charter flying already identified as separate segments of aviation."

The new name became effective June 27.

October 29-30 Set for Annual Meeting and Forum in St. Louis

Final arrangements have been made to hold the NBAA Sixth Annual Meeting and Forum at the Park-Plaza Hotel in St. Louis on October 29-30, 1953. The hotel officials are going all-out to make your stay there comfortable and interesting.

A most cordial invitation to attend is extended by the Board of Directors to the officials and pilots of member organizations. All are urged to mark October 29-30 on their calendar now as a *must* date to be filled. The program promises to be one of the most important that NBAA has ever held.

The Annual Meeting Round-Table should prove an important stimulus to thinking, action and leadership in the business-flying field. It will provide a wealth of new ideas that will help to improve the safety, service and economy of your aviation operations. As they develop, specific details of the Sixth Annual Meeting and Forum will be carried in subsequent NBAA reports.

REMEMBER . . . PUT OCTOBER 29-30 ON YOUR CALENDAR NOW!

CAA Establishes Improved Runway Marking System

Improved runway markings providing for less expensive installations at the majority of airports and more elaborate patterns for very large airports with dense traffic have been developed by the Civil Aeronautics Administration as the new national civil standard.

The markings are a refinement and elaboration of established principles which have grown out of recent experience with visual landing aids provided for pilots. They help guide the pilot on final approach to the runway and provide him with bold markings during the critical seconds when he "leaves" the electronic landing aids and "goes visual."

The improved marking system is established in Technical Standard Order TSO-N10a which recommends its installation for safer and more efficient aircraft operations.

The more elaborate of the marking is for the all-weather runways on airports with high-density traffic where the markings are more extensive and bolder, giving additional information needed by the pilot making an approach under low weather minimums. The character and quantity of the marking are scaled down from the all-weather runway to the "basic instrument runway" and then to the visual flight rule (VFR) runway where the necessary markings have been reduced to a minimum. On this VFR runway, the new centerline, which is dashed instead of solid, requires less than one-half the paint formerly used for this element. Where the old standard required four solid continuous lines down

SMITH-DOUGLASS CO.

Smith-Douglass Co., Inc., of Norfolk, Virginia, chemical manufacturers and an active member of National Business Aircraft Association, operates two business aircraft, one a *Bonanza* and the other, the *Lodestar* shown here. Originally owned by Celanese Corporation and converted by Aero Services of Van Nuys, Calif., the *Lodestar* is powered by two Wright R-1820-205A engines of 1200 hp each, and its radio equipment includes dual ADF, ILS and Sperry A-3 Autopilot. The *Lodestar* seats nine and is flown an average of 50 hours a month. Pilot of the Smith-Douglass *Lodestar* is C. B. Owen *(left)*, copilot is Paul Harris *(right)* who is also a licensed mechanic. Mr. Owen is Smith-Douglass' NBAA representative.

e entire length of the runway, the new cen-line is a single dashed line, similar to affic lines on our city streets.

The new system has been proved in actual rvice. It has been in use at LaGuardia eld, New York, for two years where some ,000 landings have been made. A similar stem is in use at Newark. NBAA, the Air ne Pilots Association, the Airports Advisory ommittee and the Air Transport Associa-on have endorsed the new markings.

The new marking system was proposed by e U.S. at an International Civil Aviation rganization (ICAO) meeting in Montreal st November as the new world-wide stand-d for runway and taxiway marking.

Copies of TSO-N10a are available free om the CAA. Write to: Aviation Informa-on Office, T-4 Bldg., Washington, D. C.

ewark Airport Passenger Term-al to be Dedicated on July 29

The date for the dedication of the new assenger terminal at the Newark Airport, ew Jersey, has been set for Wednesday, ly 29th. The Port of New York Authority ans to invite well over 500 guests to a edication ceremony and luncheon and to vite the general public to inspect the build-g that afternoon and evening. The invited ests will include leaders in government and dustry in the Northern New Jersey area d representatives of the aviation industry. he program will consist of an inspection of e Terminal Building and of the aircraft splay, the actual dedication ceremonies and luncheon on the enclosed observation deck. he public will be admitted to inspect the rminal and the aircraft display around 2:30 3:00 p.m. and the doors will remain open til 9:00 p.m. The Terminal will go into peration at 12:01 a.m., July 30.

The dedication ceremonies will be tied with the fact that this year is the 25th nniversary of Newark Airport and the 50th nniversary of Powered Flight. For that rea-n, it is planned to assemble a static display hich will consist of: 1) one of each type of rcraft now used by the scheduled airlines; one of each type of commercial helicopter w being made in this country; 3) as many amples as can be found of aircraft of the st which played a vital part in the develop-ent of commercial aviation; 4) many dif-rent types of multi-engine business aircraft. his display will be just for the dedication y. However, if enough of the older aircraft n be assembled to make it worthwhile, that rtion of the display will continue through nday, August 2nd, to attract additional vis-rs to the Newark Terminal during the eekend.

The aircraft displays will be assembled on e apron between the two fingers. It will be sible from the observation deck and will be scribed over the public address system on e deck. The planes also will be identified, scribed, and credited to their owners on gns near each plane. The guests at the cere-onies and the general public will be invited go out on the apron to walk through the rger planes and get close to the smaller es. The planes which participate in this hibit will be on the ground at Newark by 00 a.m., Wednesday, July 29th. and will main until 9:00 p.m. that evening.

It should be pointed out that this event of great importance to the entire aviation dustry in the Northern New Jersey Area. The Port Authority, the airlines and the business-aircraft owners operating into this area are agreed that the dedication of the new Passenger Terminal should be the kick-off for an "all out" campaign to sell the people in the area on the value of aviation and of airports to the community.

Commerce Official States CAA Shake-up to Help Efficiency

The aviation industry "will continue to hear of changes in the CAA and we are going to end up with a much better operation than we had before," Robert B. Murray, Jr., Under Secretary of Commerce for Transportation, recently announced. Murray stated that: 1. "Certain functions" will be removed from CAA which can better be handled by trade associations or other groups. He mentioned curtailment of the airport advisory service, on which he said the Airport Operatiors Council could do a "much better job." (An AOC spokesman said that the group will be glad to "share its information with others," and will forward inquiries to the proper sources, but has no plans to operate a full-fledged advisory service.) 2. An Air Transport Association group has recommended a 10-point program for CAA reorganization. Eight of the points have been or will be put into effect. On two points, "we definitely don't agree," it was learned that one of the points was an ATA recommendation that CAA's program planning staff be abolished. 3. Forty weather stations will be eliminated. They are unnecessary and should have been eliminated years ago. A task force has been studying all phases of CAA's operations. In an answer to rumors that there would be no reorganization of CAA, Murray said: "It has taken place."

New Landing Speed Indicator Available

Safe Flight Instrument Corp. of White Plains, New York, is marketing a Landing Speed Indicator which is designed to give direct indication of the critical speed ranges during take-off, climb, or landing approach, subordinating the airspeed indicator. The three-pound unit has a transducer installed in the wing with a small sensing vane jutting out, an adjustment box, and the indicator on the panel. The panel unit has a single indicating pointer which moves through an arc of 75°, marked by segments of red, white and green. When the pointer is centered, approach attitude is correct.

LSI automatically calculates lift coefficient, taking into account factors of gross weight, flap setting and landing gear position. Safe Flight states that the instrument immediately notes any change in longitudinal control and is not affected by rough air. It is to sell for less than $500.00.

USAF Flying Safety Magazine Available

The Directorate of Flight Safety Research, USAF, publishes an excellent monthly magazine called "*Flying Safety*." The magazine has recently been placed on public sale, and already has met with a warm reception from many airline and business-aircraft operators. It is available through the Superintendent of Documents, Washington 25, D.C. at an annual subscription price of $2.50.

Commerce User-Charge Study Termed a "Waste of Time"

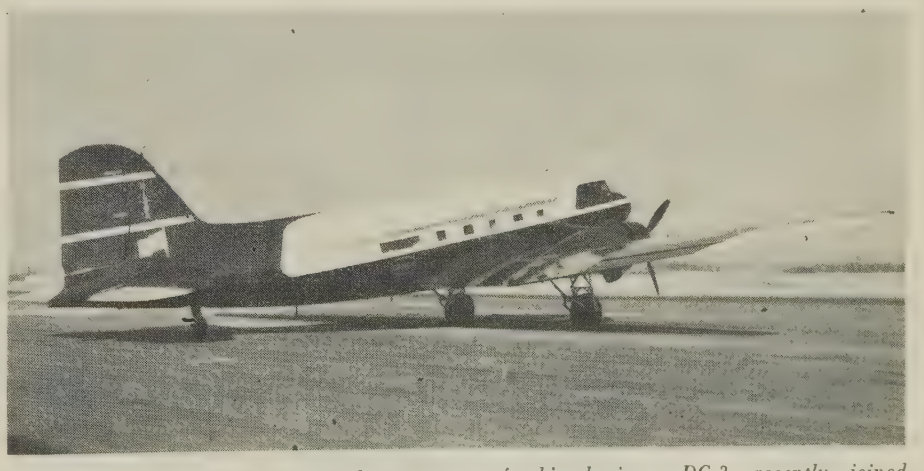
Robert B. Murray, Jr., Under Secretary of Commerce for Transportation, labeled as a waste of time the Department's year-long study of user charges for federally owned transportation facilities. It had been expected in aviation circles that recommended legislation would be based on this study.

Murray informed the Aero Club of Washington that he has been studying the report for about two weeks and "I can't visualize how a year could have been better wasted." The next question, he added, is "Where do we go from here? I don't know the answer."

Murray's frank statement makes it doubtful that user-charge legislation will be introduced at this session of Congress.

New Members of NBAA

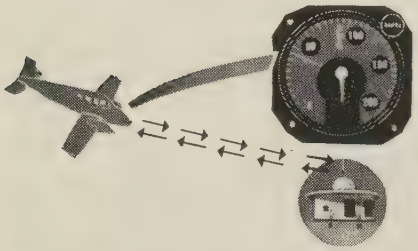
Aircraft Marine Products, Harrisburg, Pa.
American Can Co., New York, New York
The Coca-Cola Co., New York, New York
Fruehauf Trailer Co., Detroit, Michigan
Frontier Chemical Co., Dallas, Texas
John W. Galbreath, Columbus, Ohio
Pan American World Airways, New York, New York
Southern Natural Gas Co., Birmingham, Alabama



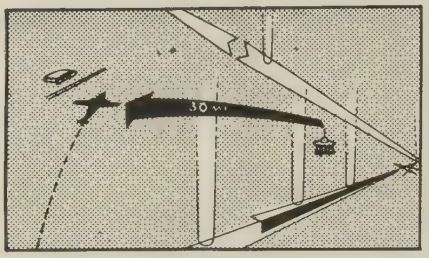
AMERICAN CAN CO., *owners and operators of this business DC-3, recently joined National Business Aircraft Association. The airplane is based at Westchester Airport, N. Y.*

NEWEST NAVIGATIONAL AID...THE BENDIX DME!

Brings provable savings that you can figure out yourself. Find out what it costs to operate your company aircraft for one hour. Find out how many hours it flies in a year. Then calculate how much Bendix Distance Measuring Equipment can reduce operating costs . . . even if DME saves you only one minute per hour! Here is a navigational aid . . . that produces *provable* savings in fuel consumption, more accurate ETA's, better holding procedures, expediting arrivals and departures, etc.

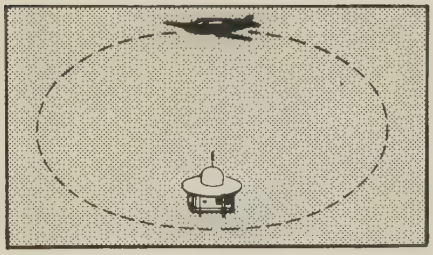


HOW IT WORKS—The DME interrogator in the plane radiates a series of radio pulses. They are received at the ground station . . . where they trigger the ground transponder. This in return transmits a reply to the plane. The elapsed time, in micro seconds, is used to compute automatically the slant distance between the plane and the ground station. The pilot simply reads the exact distance on the panel indicator.

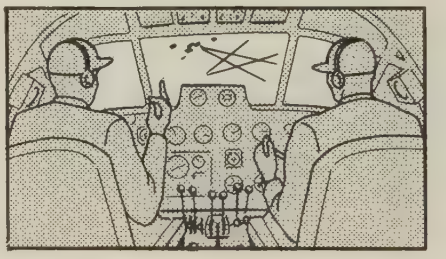


UNMARKED AIRWAYS—Pilots of corporate aircraft will be able to navigate along new and unfamiliar routes with greater accuracy and with more confidence under IFR conditions. They will not have to fly standard airways which often adds many miles to the trip. Here's another DME saving in fuel and time.

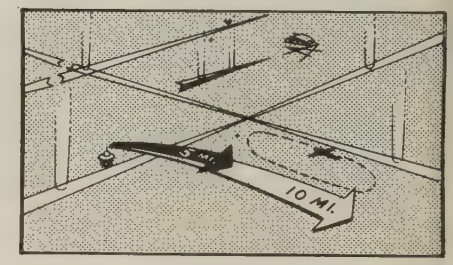
INSTRUMENT APPROACHES TO FIELD—To the operator of executive aircraft, Bendix DME equipment means that many small airfields which are within receiving range of a VOR/DME but are not served by scheduled carriers and normally difficult to approach on instruments, will now be open to him. DME equipment in conjunction with VOR provides the pilot with continuous accurate direction and distance information.



ORBITING—Regardless of wind conditions, a pilot is now able to fly an accurately controlled circular course. This exact arc can be flown around a DME/VOR at selected distances from the station and at varying altitudes. This expedites departures and arrivals. It bypasses holding stacks at intersections. It all saves time, fuel and money.



MORE ACCURATE ETA'S—The Bendix DME allows the pilot to estimate arrival times more accurately. Flight tests prove that a pilot with DME on his instrument panel can correct for headwinds, tail winds, etc. By simple calculation he always knows his ground speed. Whatever the change . . . the pilot can adjust his power to maintain his promised ETA. Save time, money and increase passenger convenience.



HOLDING AT UNMARKED POINTS — With Bendix DME, aircraft can now hold at any point within range of a DME/VOR station. No longer limited to range intersection facilities or homing airway markers. Patterns can be tighter, closer in, more accurately executed. Holding can now be on actual distance covered, not on elapsed time. No more need for wasteful wide-area "Buffer Zones."

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Thunderstorm Detection Service By Weather Bureau

At a time when most governmental rvices are being eyed by Congressmen, epartment heads, and public alike to nd ways and means of economizing by iminating unnecessary activities, it is stomary to find that many essential rvices are being curtailed, either misIkenly or deliberately, to point up the icrifices that must be made to accomany reduced budgets.

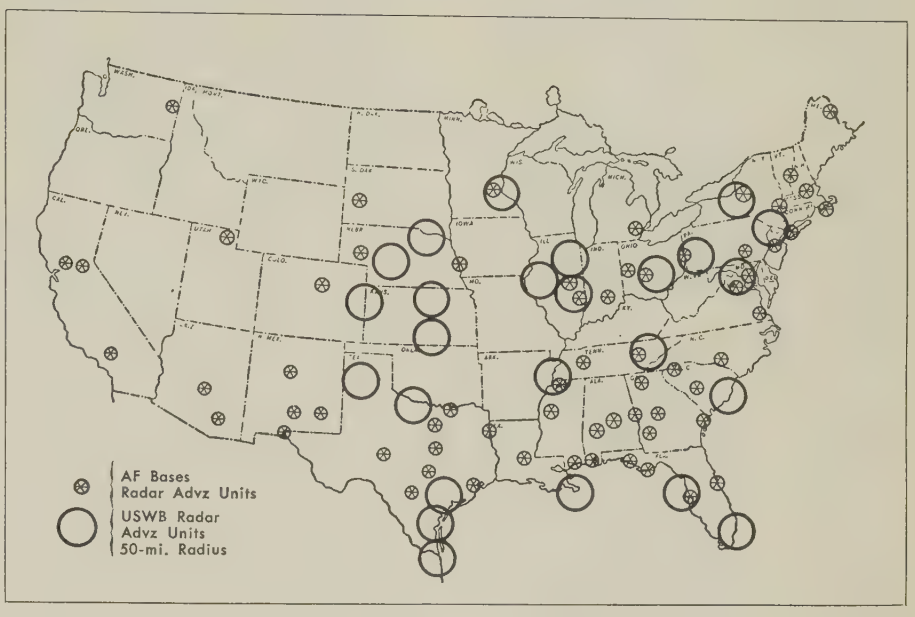
Hence, it is all the more refreshing find that some agencies are extending eir services to the flying public despite e obvious belt-tightening imposed by ie current economy wave. When one of ese agencies is the much abused Veather Bureau, already operating on a arvation diet, it is cause for great reicing on the part of pilots everywhere.

Little advertised (and properly so, unl all the bugs are worked out and the al measure of the service evaluated) is ie Radar Storm Detection Service now ade available to the aviation industry v the Weather Bureau. With 25 staons already operating (and more to me when funds permit) and despite ie limitations of already obsolete equipent, these stations are endeavoring to rovide the pilot with such advance arning of thunderstorm activity as ight have prevented the Lake Michian and Gulf of Mexico tragedies.

Generally, the radar equipment has een spotted around those portions of ie country in which thunderstorms are ost prevalent. The ability to spot and lentify these meteorological hazards indudes not only the common thunderorm but the even more hazardous rnado and other phenomena of similar reat.

Such a station at Daytona Beach this ring could have resolved much doubt nd delay to air traffic when a "tornado" as reported in that vicinity at a time hen high winds and general storm conitions were prevalent from Melbourne Charleston. Although it was impossble to obtain reliable confirming or enying reports to localize the condition, it existed, traffic was virtually stopped ntil consistently negative reports sugested the passing of the condition which ad prompted the report in the first lace. Although not infallible, radar surcillance could have eased the problem nsiderably.

Primarily concerned with the detecon and tracking of all storm conditions r the purpose of weather prognostication and analysis, the development of this aid to flying as a direct service probably followed the informal use of Airport Surveillance Radar in civil and military towers to assist pilots in avoiding the centers of precipitation and turbulence when arriving and departing from airports so equipped.



Curtailed only by other duty requirements, this airport radar storm avoidance service is usually available on request, or quite frequently it is volunteered by ATC personnel interested in giving additional service to pilots. Particularly in metropolitan areas employing radar control of traffic, it is in the mutual interest of both to steer a pilot clear of such target-obliterating areas on the radarscope. In an earlier issue of *Navicom (February, 1953)*, we illustrated and described the effect of such storm areas and how their centers of heaviest rain and turbulence could be defined and circumnavigated.

One of the greatest strains on pilots who are on instruments in areas of known or forecasted thunderstorm activity is the fact that they cannot anticipate accurately or evenly approximately when they might go busting into a grandpappy of a thunderstorm without any warning and with highly dangerous results; or they must operate the entire flight through such areas with self-imposed and often unnecessary limitations as a measure of caution. To fail to do so threatens to make the headlines.

Hence, it is a real boon that not only can the forecasters employ these devices to assist in their art, both predicting, confirming and amending their estimates, but the pilot, by use of his radio in flight or in person on the ground, can obtain specific information as to the extent, apparent intensity, location and course of movement of these storms, and then can adjust his flight plan so that he circumnavigates the area of disturbance.

As with all good things, there are limitations to the service, and the pilot should understand these limitations so that he can properly evaluate and employ the information he receives and not expect the impossible. Primarily, it should be understood by all pilots that this service is an offshoot of the development of this informaion for general forecasting purposes. Neither Weather Bureau funds nor availability of personnel makes it possible for the bureau to take a pilot by the hand and lead him around every storm center in any specific area, especially when VFR navigation would enable the pilot to do so for himself.

If an excessive number of pilots calling upon the service from pure curiosity, laziness or lack of normal pilotage judgment overloads the service to the point of curtailing the major responsibility of over-all weather forecasting, the service will suffer and quite possibly cease. It must be remembered that the Weather Bureau is not solely a service to aviation. There are many other taxpayers who rely on its services for their daily needs, and especially with respect to this storm-warning service.

It is to be hoped that eventually both the Weather Bureau and CAA Airways

(Continued on page 34)

Thunderstorm Detection Service By Weather Bureau

(Continued from page 33)

Communications Station services will be able to immediately broadcast in the blind all RAREPS (Radar Reports) concerned with apparent or obvious strong storm indications for the benefit of all airborne traffic, without the time lag currently present in the issuance of a revised terminal or other forecast *(and this only where such storm indications are not consistent with previously issued forecasts!).*

It may be difficult for the Weather Bureau policy makers to realize that a forecast of thunderstorm activity is so general a thing to a pilot that often a seasoned and weather-wise pilot can make this prediction for himself, but he is still interested in knowing when an actual storm center lies squarely on or is rapidly approaching his immediate flight path along the airway, when he is on instruments.

Currently this information can be obtained by calling the nearest INSAC (Airways Comm. Sta.) at one of the points listed below. (Perhaps the determination of when to *automatically broadcast* this flight-hazard information could be governed by the prevalence of certain standards of reported weather at enroute stations which would indicate the probability of IFR airways traffic, further limiting it to reasonable proximity of the airways affected. Anyway, this is not yet the case, so pilots on IFR plan who desire this service should request it.) Reports from these stations are transmitted over Service A CAA weather teletype circuits at 10 and 50 minutes past the hour. Reports in-flight may also be obtained, as previously stated, by calling the nearest INSAC station:

Amarillo, Tex.	Miami, Fla.
Brownsville, Tex.	Minneapolis, Minn.
Burrwood, La. (on tip of Miss. delta mouth; call New Orleans)	New York, N. Y.
	*Norfolk, Neb. (95 mi. N. W. Omaha)
Charleston, S. C.	North Platte, Neb.
Chicago, Ill.	Pittsburgh, Pa.
Columbus, O.	Syracuse, N. Y.
Corpus Christi, Tex	Tampa, Fla.
Dodge City, Kan.	Urbana, Ill. (15 mi.
Goodland, Kan.	S. of Chanute)
Hanna City, Ill.	Victoria, Tex.
(W. of Peoria, Ill.)	(West of Palacios)
Knoxville, Tenn.	Washington, D. C.
Memphis, Tenn.	Wichita Falls, Tex.

(*This facility transmits weather only. Guards 122.1 mc and 3105 kc, transmits 122.2 mc and 290 kc, 0600 to 2300 daily!)

The Air Force operates weather radar stations at most bases and their reports are available in the same manner.

With respect to calling for information other than that already made available by the Air Force stations, the following word of caution is desirable. Such a service obviously cannot be made available for routine use as it would seriously interfere with the vital activities of these stations. In an emergency (genuine—for which the pilot might later be asked to account) such radar storm detection information can be obtained in flight by calling the control tower of the AF Base concerned. If not equipped with the 126.18 mc frequency common to military towers, 121.5 mc (universal emergency frequency) could be employed judiciously with consideration for the restricted use of this frequency.

In another commendable approach to the problem, the Air Transport Association has arranged an experimental procedure with the 30th Air Division, USAF Headquarters, Ypsilanti, Michigan, which will provide this service to scheduled air carriers within the limits of this command which takes in eastern Illinois, Indiana, Kentucky, Michigan, Ohio, western Pennsylvania, West Virginia and Wisconsin. (This service will differ from others already provided by other Air Divisions in their commands in that the units will *initiate* broadcasts of storm information.)

Subject to trial test (possibility of conflict with Center transmissions from

Air-Aids Spotlight

118.1 mc—*This frequency being dropped from all airport facilities not handling a high percentage of international traffic and in conflicting proximity with truly international service airports. Where additional primary tower VHF needed, same is added. (Check Air Guide, manuals) Examples: Baltimore, Dallas, Mobile, Newark, etc.*

VAR to VOR's

The East Coast VAR airways changeover to VOR still lagging behind the western routes. Salisbury, Md. VOR still not commissioned with VAR reported rough. Norfolk, Va. *still on VAR, but* Elizabeth City, N. C. *going VOR, due in Sept.;* Rocky Mount, N. C. *due in July;* New Bern, N. C. *due in July, freq. probably 114.1 mc;* Wilmington, N. C. *due in October freq. probably 113.6 mc;* Myrtle Beach, S. C. *due in August, freq. may be 117.8 mc.*

NEW VOR's

ORLANDO, Fla. *on 112.2 mc installed on the airport.* MOOSUP, Conn. *being tested on 111.7 mc.*

VOR CHANGES

BRUNSWICK, Ga. *resumed operation on 114.2 mc.* ROCHESTER, Minn. *due back this month after modernization.*

ILS CHANGES

BEDFORD, Mass. *out of relocation at end of lengthened runway.*

HOUSTON, Tex. *out for relocation. Practice Radar control being conducted on 120.7 mc.*

NEW BEDFORD, Mass. *Localizer now 109.7 and Glide Path on 333.2 mc.*

KNOXVILLE, Tenn. *ILS and COMLO's out, plus Binfield MHW moving to new LOM site.*

MACON, Ga. *and* MEMPHIS, Tenn. *ILS due back.*

ORLANDO, Fla. *Glide Path commissioned. Altitude over Outer Marker 1330 feet, over Middle, 340 feet.*

SAN ANTONIO, Tex. *ILS should have resumed operation.*

WORCESTER, Mass. *ILS due back on 108.1, Glide Path on 334.4 mc.*

MISCELLANEOUS

KANSAS CITY, Mo. *Low frequency range to resume normal operation, meanwhile usable for homing only on 359 kc.*

HUNTINGTON, W. Va. *Hi-Intensity lights at Tri-State Airport continuous operation sunset to midnight, on request midnight to sunrise.*

SAVANNAH, Ga. *and* LA-CARNE, Mich. *Danger Areas being Radar monitored—Adhere closely to airways in these areas!*

NEWARK, N. J. *ASR-2 Radar antenna lowering should see commissioning of this facility.*

DALLAS, Tex. *All IFR traffic off airways north of Green 5 east of Dallas and northeast of Dallas on Victor 15, guard 119.5 mc for Radar ATC instructions from CAA-AF "Perrin Control".*

SALT LAKE CITY, Utah. *New dual VOR approach via Ogden and Salt Lake VOR's to Runway 16 should be monitored by guarding South leg of Ogden LFR.*

djacent ATC areas, etc.) a frequency of 24.1 mc has been selected. When a ven AF radar unit detects a storm area apparent severity, it will immediately itiate a general broadcast on this fre- ency giving the area by reference to signated geographical locations or ajor cities, and thereafter at intervals 15 minutes, as at 10, 25, 40 and 55 inutes past the hour. Although origi- ally worked out by the ATA (to whom l credit should be given), the service available to any pilot capable of tun- g 124.1 mc.

It should be noted also that this in- rmation will be transmitted to the as- ciated CAA ATC Center for its use nd relay to the Weather Bureau, both whom will pass it on to the Airways ommunications stations for dissemina- on to the flying public not aware or ble to tune the above frequency.

Further expanding the value of the xpayer's dollar, individual weather cir- umnavigation service will be rendered r-carrier flights upon request to the as- ciated CAA ATC Centers. If the ren- ering of this service would interfere ith vital activities of the unit con- rned, a simple, concise reply, "Un- ble", will be received.

If the circumstances indicate that the "Unable" is not so inspired but rather ecause you are not one of the club, nsult your local Congressman! And, gain, the quickest way to discourage ntinuance of or expansion of this serv- e will be to make excessive demands on or to abuse it. If you have favorable xperiences, you might also tell that to our Congressman.

Washington Area Inno- vations Speed Traffic

Although the experimental station of he CAA is at Indianapolis, the rapidity nd frequency with which new and ef- ective procedures, techniques and fa- ilities are instituted at the Washington National Airport gives fair competition.

With the commissioning of the new Georgetown radio beacon, making pos- sible approaches from the northwest in IFR weather, radar vectoring already in progress and the new TVOR on the field, much less than the usual period of familiarization and fumbling took place before snappy landing intervals were be- ing achieved on this long-needed north- west approach.

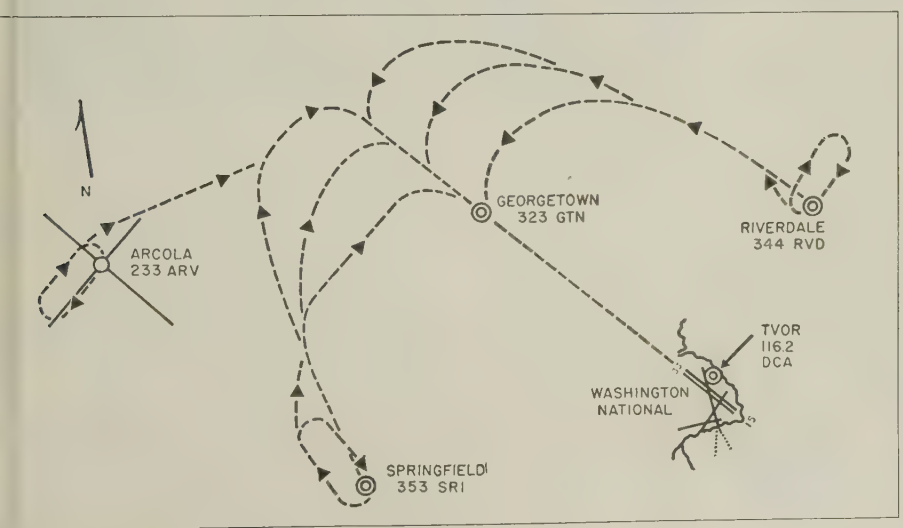
Similar to the well-established radar vectoring to the ILS course landing north, inbound flights are fed off both the Riverdale radio beacon holding pattern and the Springfield pattern, vectored by radar onto the final ADF approach course over the Georgetown radio beacon, and turned loose for the ADF approach without the delaying heading tie-down *(See sketch below)*. Over Georgetown, the pilot on final can obtain the usual radar monitoring "ad- visories" on his approach path by listen- ing to the voice facility of the Washing- ton TVOR on 116.2 mc.

If the pilot feels a little "crowded" by the close interval thus achieved, he can request and will be given standard ANC separation and, of course, if he is even more of a rugged individualist, he can decline the proffered assistance of the "advisories" and shoot a complete ADF approach on his own. Both the pull-out in event of a missed approach and the radar departure routings are revised to suit when these northwest approaches are in progress. *A cautionary note:* Re- member that radar advisories at any air- port so equipped are with respect to flight track (in azimuth) only, not eleva- tion (or Glide Path), except when a com- plete front course ILS approach is made!

Washington-Philadelphia Gets Low-Altitude ATC

Along with the other areas in the country acquiring low-altitude ATC con- trol between Approach Control towers, the Washington Center has delegated to the Washington, Baltimore and Phila- delphia Towers, the airspace along the

(Continued on page 36)



Washington-Philadelphia Gets Low-Altitude ATC

(Continued from page 35)

intervening airways up to 4,000 feet.

The significance of this is in either no delays at all or in shortened ones in obtaining clearances IFR between these stations and at these altitudes as a result of not competing with the longer range flights into this same area for Center processing. The Center coordinates only with these towers when it is necessary to descend or climb a long-range flight into or out of these stations.

Most often, you will be cleared from local fix to local fix within the successive jurisdictions of these towers with virtually no or little delay at take-off and enroute. In this operation it is important that the pilot understand that he is solely in the control of the respective Approach Control Tower; an inadvertent and undirected call to the Center for clearance will find the Center startlingly unaware of the flight's existence!

Since the combining of the Washington Center and Station, there have been occasional hassles with pilots who are not sure to which facility to address their calls. In general, it is suggested that IFR flights, except as noted above, call "Washington Center" employing the appropriate published frequencies, and VFR flights call Washington, Andrews, Arcola or Herndon "Radio," whichever is appropriate to their location.

Incidentally, thinking of the "runway approach" visibility taken here by radar, the visibilities so reported apply only to the use of the ILS runway approach along which the gadget is pointed. Thus, if the radar visibility on that approach is locally below minimums but the weather observer is reporting a higher and usable visibility for the airport, a circling approach or straight-in to another runway may be quite legal!

Pilot Brush-Up on IFR

An informal survey of check pilots, instrument instructors and an analysis of missed-approach records reveals many interesting and fruitful facts about the why's and how's of such misses.

Many of the factors leading to "misses" are not necessarily factors leading to disastrous circumstances, nor are they easily blamed on "pilot error". For instance, it was found that many cockpit-design faults led to instrument "go-arounds" that would otherwise have been completed landings. Various indicator lights in the cockpit and other attention-arresting devices going off at critical moment of the approach, ma distract the pilot long enough to allo the heading to wander too far to r cover in time to effect a landing, etc.

Nevertheless, a certain number of cor sistent pilot-procedure faults indicate that many simple principles, onc learned, are easily forgotten. A to check pilot for one of the largest airline was asked to list his suggestions for pilo brush-up on IFR approach technique These are his suggestions:

1. Re-familiarize yourself with all th aids of the terminal area in which yo are planning an approach.

2. Review your procedure in terms c the equipment available to you.

3. Check and warm-up all radio equi ment well in advance to make sure it operating normally before you need i

4. Double-check your altimeter an gyro equipment before starting descen

5. During the approach, do not ban in excess of 20° to insure maintainin air speed within safe limits.

6. Do not chase or fly the needle the ILS cross-pointer! Select your hea ings carefully, fly them accurately wit the gyro, make heading corrections necessary *by reference only* to the Loca izer Course needle, for deviations your track over the ground.

7. When flying outbound prior turning inbound on final, observe you wind correction angle and compute you probable inbound heading. Do not co fuse your plus' and minus'.

8. Do not rush the approach! G sufficiently out beyond the Outer Mark or procedure turn fix to insure ampl time to tie-down the course before co mencing final descent close in.

9. Control your power, do not chang it in bursts, but try to bracket your ai speed within safe limits rather than a tempt to hold an exact airspeed.

10. Visualize your terrain clearan and adhere closely to recommended l down rate, and when over Middle Mar er (if ILS), pull out if not able to s the runway, or if not down to minimum

11. Do not engage in research if th ILS flag alarm or other equipment ou age indications show up, but discontinu let-down immediately and pull out.

12. Employ all facilities availabl such as ADF on COMLO's and GCA a visories during ILS or other approache

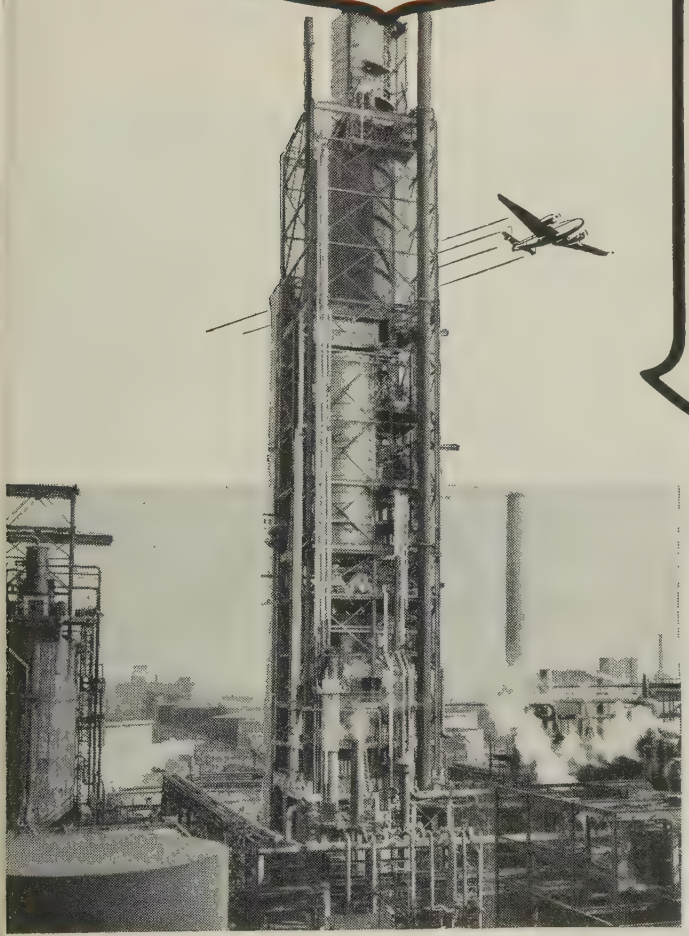
13. Check altimeter when over Out Marker for proper altitude to insu accurate Glide Path indications befo commencing descent.

14. Listen to your ADF, if using it primary approach aid, to insure that doesn't drift off frequency, get knocke off or get "captured" by another facili of close frequency.

15. Do not try to superman the a proach by conducting all communic tions as well. Trust your copilot handle this end or get another copilo

BEST PAIR to Get You There!

Mobilgas AIRCRAFT



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Why Accept Anything Less?

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

Skyways Round Table

(Continued from page 23)

ice in our operation for that simple reason.

"We've had several friends in this fixed-base business who've had airplanes burn up or blow away, and they've had to pay for the aircraft because they took a $2 tie-down fee. You can't charge a high enough tie-down fee to compensate you for the insurance premium necessary to protect yourself. It just isn't economically practical."

Service Charge

Louis R. Inwood: "I've been aware of that fact from the operators on the airport from which I've been operating. The only other chance is an over-all landing fee that would be remitted to the service operator. That, however, poses a difficult problem because there is a great deal of resistance to an airport that has a landing fee."

Cole H. Morrow *(Chief Plant Engr., J. I. Case Co.; Chm of Board, CAOA):* "It's quite obvious that the variations in size of airplanes being operated for business require a wide variety of services. When a DC-3 lands at an airport away from home base, it requires about the same kind of service as an airline DC-3. To get some idea of that kind of service, it's only necessary to look at the crew that swarms around a DC-3 airliner when it comes in. A great many business-aircraft operators have expected that same type of airline service on the basis of a minor charge for it. In some cases merely the sale of the gasoline should cover it. Obviously, that isn't economically equitable.

"I do believe, however, that a great many of the larger operators who have been in the business of operating those airplanes for quite awhile, realize and recognize the economic problems involved and are willing to pay for the minimum service they require. The one reason the landing fee that Mr. Inwood mentioned has always been opposed by most airplane operators is because it did not mean that they were going to get anything in addition to what they already were getting without paying a landing fee.

"I think the opposition to the landing fee would vanish from corporation-aircraft operators if it were directly related to some specific service they would get at that airport. In the case of municipal airports, one of the big mistakes has been that the municipality collects the landing fee, and then the fixed-base operator comes along and puts on an additional charge for whatever service he renders.

"Obviously, service costs money and has to be paid for. I happen to know because I also run an airport, and I know there are many problems confronting the airport operator.

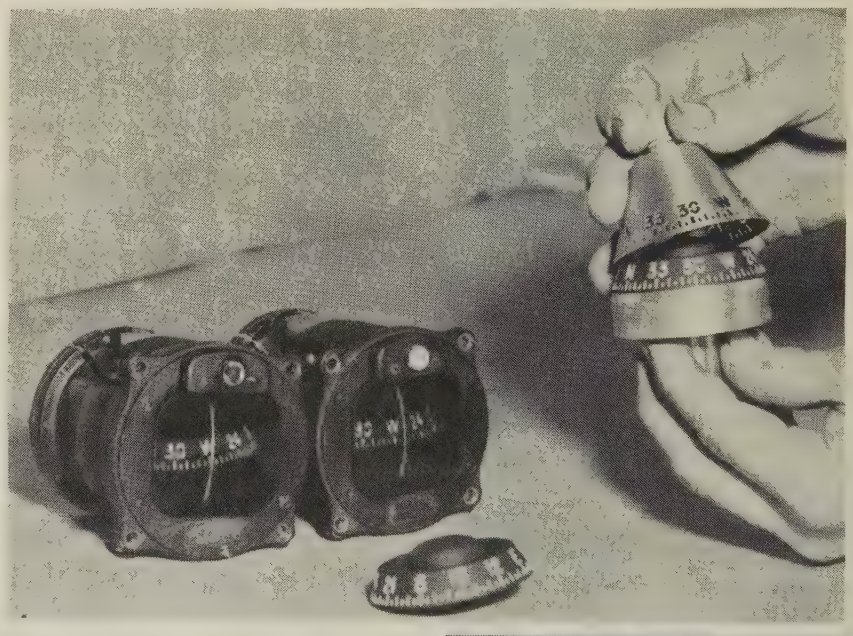
"There is one other point I'd like to make: The business executives in our company raise their eyebrows when they hear, 'Send the line *boy* out.' They don't want 'boys' working on their airplanes. The use of the word 'boy' has a bad psychological effect."

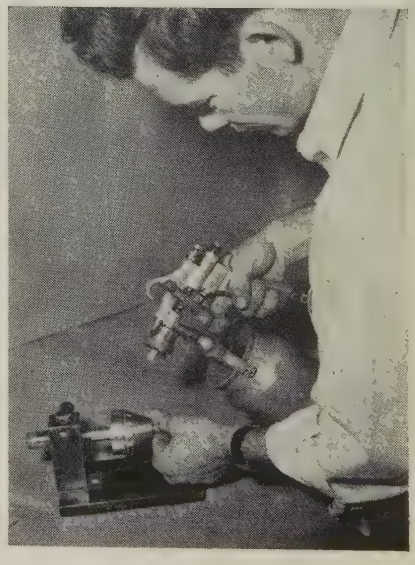
Ralph Piper: "He is the serviceman in most operations, and that is his official title."

Cole H. Morrow: "I think some salvation to the problem can be realized if the service to be rendered by a fixed-base operator is extended to the aircraft that are based on that field as well as to the transients. What we've talked about here has been directly applied to the requirements of transient aircraft at a visiting base. The revenue at that base from a transient isn't going to be anything like the amount of revenue that a fixed-base operator can realize from an airplane based there. A fixed-base operator will be in a much better position to render good service to a transient if he is also rendering that same kind of service to the aircraft that are based on his own airport. I've noticed that a great many fixed-base operators are not even getting the business on their own airports for the simple reason that they aren't supplying what the airplane owner requires. In some cases this is probably due to the fact that the fixed-base operators don't realize the potential. As a result, a great many companies have gone ahead and set up their own shops to handle maintenance and all kinds of servicing work which, in the majority of cases, they would prefer to buy from the fixed-base operator, provided he could give the kind and quality of service required.

"Again, being an airport operator, which also includes the fixed-base operation, I have found that low-quality service at a price is the most detrimental thing a fixed-base operator can offer a business-aircraft operator. The best mechanic you can hire, even if you have to charge the customer a higher rate per hour, will result in a lower over-all cost to the aircraft owner and more business for the fixed-base operator."

Louis R. Inwood: "Mr. Morrow, I believe you have a better opportunity to operate an airport successfully than the average municipality. If the service at a given airport is a monopoly, it can be controlled and usually





COMPASS STENCIL

Painting dials for B-16 type compasses has become a simple operation since the development of a special stencil by the Temco-Dallas engineering and tooling departments. Due to its shape, (a truncated cone with the degree marks on the side), the dial does not lend itself to normal painting operations, and markings must be accurate as slightest error could result in faulty navigation. Devised by Temco, a hollow conical stencil fits over the face of the dial mounted on a swivel base. Stencil and dial are rotated while the paint is sprayed on with an ordinary spray gun. Use of this stencil eliminates tedious hand painting on the dials and insures extreme accuracy.

the volume of service, both quantitatively and qualitatively, helps the situation. Most municipalities throughout the U.S., or any other governmental agency operating the airport, try not to usurp the private prerogatives of business. They merely operate the airport, and service agencies which have been granted franchises take care of the service end of the airport operation. On most airports, service is maintained on a competitive basis.

"From my experience in flying around the country, and I've done a fair amount this year, I've found that the service at the airports where a monopoly exists is superior to the service where there is competition on the airport. Yet the rule of the municipality is to welcome any citizen who desires space on the airport, and allow competition to regulate the activities and the service.

"In your particular case, Mr. Morrow, you own the airport and can run it in the manner that you see fit. But in the majority of cases, the airports you want to stop at are run by a municipality. Perhaps the $64 question is, 'Should a municipality attempt to run an airport in a manner similar to a privately owned field . . . should a municipality try to concentrate the business as a monopoly and, if they do, what about the resulting public opinion and political pressure?' "

Cole H. Morrow: "I think our experience at Racine points up one very significant fact: that if all of the business on a given airport could be run through one set of books, a great deal of opposition to airports in general as being liabilities would be completely removed. It would definitely show that the airports really do stand on their own feet.

"One of the reasons for a degeneration of service where competition exists on a field is that by splitting up the pie in such small pieces, you end up with a group of businesses, none of which have either the financial backing or the total volume of business on which to establish the type of service to meet this growing need of business-aircraft users.

"There is one other factor that I'd like to point out, and that is that the growth of business flying has been so fast that many fixed-base operators are not equipped to give the type of service required, because the type of aircraft we are operating is much larger and more complicated than that which they have been accustomed to servicing.

"Slowly, this is being corrected, and the thing I'd like to point out here today is not a criticism of fixed-base operators who are doing the best they can but rather to point out the market that exists in this field, and to offer aid and suggestions as to how the fixed-base operator can become a better and bigger businessman to take advantage of the business potential that is available to him."

Wiley R. Wright: *"Mr. Hackett, do you have a question or a comment to pass on to us?"*

Virgil W. Hackett: "My question relates to the statement that most corporations would prefer to have their maintenance and service work done by fixed-base operators. We took over an operation some six months ago, and we've gone into it from the standpoint of trying to provide the services we know everyone wants. But the thing we're finding is that where a corporation has a two-man crew on a multi-engine airplane the front office of that company feels those fellows should putter around the airplane, and a lot of them do. I don't know how true that is around the rest of the country, but we've found it to be true here in Kansas City."

Cole H. Morrow: "If the Chief Pilot is in charge of the airplane, one of the requirements of that position is that he has enough business acumen, in addition to piloting ability, to point out in a businesslike manner to the businessmen he's working for what is actually involved. I don't think he will have any difficulty whatsoever when he presents a logical business argument as to why the fixed-base operator, who has many thousands of dollars invested in special equipment and specialized personnel, can do that job better than he can with his small box of tools and his limited ability and time. When the crew is puttering around an airplane, as you put it, the 'management' of that airplane is usually suffering. Of course, there are many things that the crew can do better than you can, and you'd be far better off as a fixed-base operator to have the crew do them. I'm speaking now of very minor nuisance types of maintenance

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Skyways Round Table

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jobs, like tightening a bolt. That's probably an extreme case, but there's certainly no reason why a pilot or copilot-mechanic can't tighten bolts. But when it comes to maintenance work on such a highly specialized piece of apparatus as an airplane, I think a businessman realizes that people with special tools and specially trained personnel can do the job faster and cheaper in the long run than someone not properly equipped."

Virgil W. Hackett: "I shouldn't have used the word, 'putter.' Actually, I'm referring to heavy maintenance. The tightening of an occasional bolt by the copilot-mechanic is all right.

"There are a number of other sources of revenue for the fixed-base operator, and one of them is the cleaning and polishing of aircraft. With service people on a 24-hour operation, there are a number of dead spots in the day when work like that could be done. But if the crew members of the plane do that work themselves, the serviceman sits there, does nothing and gets paid for it.

"I'd like to check Dick Washburn's experiences along that line. We at Executive Aircraft are too new in the business to have enough history to refer to."

Richard R. Washburn: "We've been in the business a little over six years now. In that time we've grown from a small operation that owned two J-3 *Cubs* and a broken-down Twin-Cessna to a middle-sized operation, and it's been an uphill fight all the way.

"I think we're missing the boat a bit here in this discussion. While it's true that of a total of 10,000 business aircraft there are some 1800 multi-engine airplanes in use, we've apparently lost sight of the fact that there are 3,000 fixed-base operators in the country. That gives an average of three service operators to 10 aircraft, or about three airplanes per operator throughout the whole country. That means there's a very selective market with everybody fighting for the potential customers available. Our big problem, therefore, is to sell more airplanes and develop a bigger market to make more money through service to that enlarged market. That's what we've tried to do in our territory.

"When we started out we had eight or nine aircraft based with us; now we have 37 and we're writing in black ink for a change."

Louis R. Inwood: "You stated, Mr. Washburn, that your approximate sale of gasoline ran some 25,000 gallons. Do you provide 24-hour service?"

Richard R. Washburn: "We tried it, but we've now limited it to 18-hour service. Twenty-four hour service wasn't economically feasible."

Louis R. Inwood: "I was going to suggest that with 24-hour service seven days a week, the total gross would pay for the service mechanic. The problem seems to be to maintain the frequency of the corporate business to sustain the quality of service that is demanded.

"Reverting to the monopoly question, at most of the larger airports there is a sufficient volume of business, if undivided and put up to competitive bidding for one sole operator, to raise that volume of 25,000 gallons to maybe 100,000. When that volume is reached, it begins to make it possible for the service operator to offer the type of service that has been requested here today. However, that again poses a problem. When you confine the sale of gasoline to one operator, you immediately have the oil companies insisting that there be no monopoly on the sale of any one brand of gasoline on the airport. Frankly, we've had a couple of lawsuits on that subject, so you can see that there are many factors in this business.

"Many operators do not pump as much as 25,000 gallons, and a few pump a great deal more, but you'll find that those few do not depend upon business-plane operators alone. They usually have a contract with two or three non-scheduled lines which they also serve, and this brings their volume up to the point where they can afford to give the line service desired.

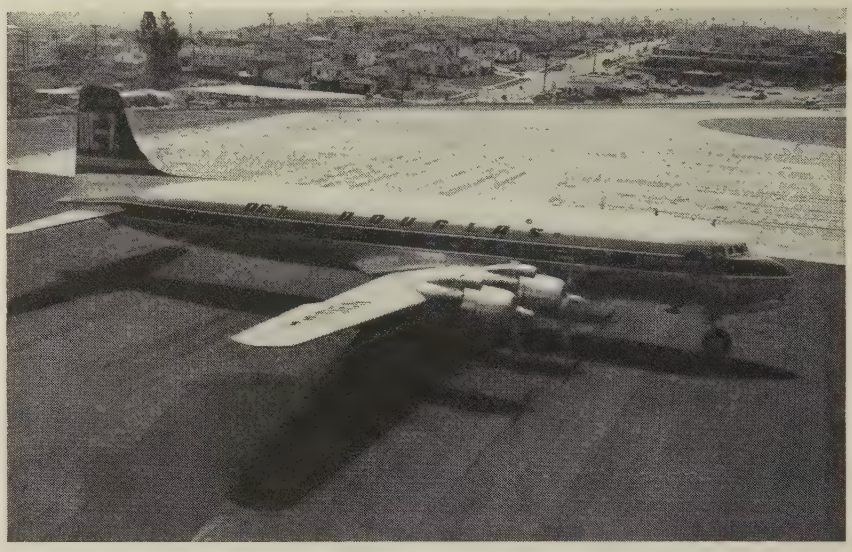
"Two business-plane operators suggested recently that the larger airports set aside at least two gate positions for the servicing of business aircraft—disembarking and embarking their loads—and to limit the loading and unloading time to about half an hour; that's what most airports demand as the maximum time for the scheduled airlines. If that were done, the passengers of a business-aircraft would disembark at that particular gate position and then the pilot would either call a fixed-base operator to come and get the plane or he'd taxi to the base for servicing. There again, however, the profit opportunities do not revert to the fixed-base operator who has to provide the service. As far as the airport is concerned, those gate positions have to be amortized and there exists a landing charge for the scheduled airlines and other carriers who use those gate positions. There is no service provided other than maintenance of the gate positions and the facilities dependent thereto. Very few of the major airports in the U.S. are doing any more than breaking even, financially."

Wiley R. Wright: *"If a landing fee is charged or should be charged at those airports where no fees now exist, should that fee go to the airport or should it go to the operator giving the service?"*

Richard R. Washburn: "As we all know, an airport is a tremendously expensive thing to maintain. If a landing fee is charged, that money usually goes into the maintenance fund of the airport, and the operator on that field does not have any opportunity to gain revenue from that source. Frankly, I don't see how they could expect to. We are located on a relatively large airport where we have 70 air-carrier scheduled movements a day, plus a number of other landings and take-offs. You don't maintain an airport of that size for free, and if the municipality or airport owner had no source of revenue, you'd soon hear the taxpayers crying that it's a liability, I don't think you can substitute a landing fee for an income source for the operator.

"In our operation, we've tried to reduce the

(Continued on page 42)



DOUGLAS DC-7, *shown here on the ramp at Douglas Aircraft's Santa Monica plant, recently made its first flight. Closely resembling the DC-6 series of air transports, the DC-7 is powered by Wright R-3350 turbo-compound engines, each delivering 3,250 take-off horsepower. Average cruising speed is 365 mph; top speed, 410 mph*

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Skyways Round Table

(Continued from page 40)

cost to the user rather than tack another cost on everytime he turns around. Our underlying thought throughout our operation has been to develop volume through sales of aircraft and through the utility of those aircraft, rather than try to enter a highly competitive field and cut everybody's throat to get that last nickel. We've all got to work together to build ourselves a bigger market in which to operate. That's our only salvation."

Louis R. Inwood: "Whereas the number of landings and take-offs of other than scheduled airline aircraft at the Kansas City airport, for example, is greatly in excess of the number of landings and take-offs of the scheduled aircraft, the income as far as the airport is concerned is about 10% of the income proper received from the scheduled air carriers. Whatever the demands for service are on the part of the other-than-scheduled-carriers, the scheduled carriers do pay their way. They've been forced into it rather reluctantly at times, but nevertheless they do pay their way. The landing fee proposal is one that must be met fairly and squarely. If service is needed, then that income must be figured in some manner to accrue to the man who is furnishing that service, the fixed-base operator."

Revenue vs. Non-Revenue Operator

Cole H. Morrow: "I'd like to comment on something Mr. Inwood said. Inasmuch as the scheduled carrier is a revenue operator, he is in an entirely different position with respect to the operation of his airplane than we who are non-revenue operators but who use the airplane as part of our business operations. Furthermore, since we have absolutely no recourse to mail pay and other methods of passing on charges, and since we also have to foot the other end of the bill, the taxpayers' part, through another channel, there's been some differences of opinion develop over this matter of charging.

"In connection with this and to illustrate my point, I'd like to inject something of the J.I. Case Co.'s business. We manufacture 77 different machines in order to complete a line. We furnish repair parts for any machine we ever made, and since we've been in business for over a hundred years, you can imagine what that means. If someone comes in and wants a connecting rod for a threshing machine that was built in 1870, we have it there for him. The point I want to make is that while we have a very broad line of products, we do not make a profit on everyone of them. I don't think any business can say that it makes a profit in every line of service it provides. We manufacture some machines solely to complete the line and to present a complete service to our customers, and sometimes at a considerable loss to the company on a specific item. Much of the discussion here has been on the sale of gasoline, which I know from my own experience is a very small percentage of the total business potential and the gross income which can be realized by the fixed-base operator.

"Since we're discussing the over-all profit potentials of fixed-base operators, I think we've got to get over into some other fields. Mr. Washburn has stated an objective which CAOA endorses, and that is to increase the market rather than argue how to divide up a small one. If we make it bigger, there'll be enough for everyone. That's the goal and the objective that all of us are really shooting for. We must encourage the growth of business flying so that it will not only be of benefit to companies that own airplanes but will also build up the fixed-base operators on whom we will depend even more in the future for the sales and service of airplanes and the equipment that goes in them.

"A tremendous volume of business is offered through the sale of radio equipment, the sale of parts and the operation of a service shop. You mentioned there being 3,000 operators and another figure, $175,000,000, was quoted as the amount spent in operating and maintaining company aircraft per year. If I do a little average calculating right here, I come out with a pretty sizeable amount of money. The potential is there, maybe not for every or all fixed-base operators, but certainly for a large number.

"There are many things we need in this business-flying phase of aviation, among them is the help and enthusiastic support of all segments of the aircraft industry. I'd like to say again that the potentialities have not been fully realized, particularly for the fixed-base operator. We feel he should be a part of all planning for the future growth of business flying. Right now we are encouraging the manufacture of a new airplane, and we have recommended vigorously that the manufacturer of the airplane produce nothing but the airplane, and allow the fixed-base operator to sell as much as possible of the accessory equipment that goes in it. We also want the fixed-base operator to install it and to be equipped and able to service it. We realize that if we expect the fixed-base operator to have the tools and special apparatus to maintain some of these larger and more complicated aircraft, he must also have part of the business and the profit margin to enable him to build up his capital outlay so that he can provide adequate facilities. Therefore, I think that any discussion of the sale of gas and oil hardly scratches the surface of the total business available to fixed-base operators."

Wiley R. Wright: *"Indeed there are many potentialities other than the strict servicing of aircraft. In connection with that, I'd like to refer to a pamphlet we've just completed in Washington and which was developed to call fixed-base operators' attention to other phases that they could utilize profitably in their business. The title of the pamphlet is,* 'Added Profits for Aviation's Fixed-Base Operators,' *and we want to get it into the hands of every fixed-base operator in the country.*

"In connection with profit opportunities, I'm sure Jimmy Redwine, former Chief Pilot for Riss & Co., has comments to make."

James B. Redwine: "I'll go along with Ralph Piper on the things he mentioned earlier. The only other comment I have to make is that I think these servicemen that you've mentioned should be service salesmen as well. I had an experience along that line that proved to me what an alert serviceman can do. I made an overnight stop at a field and, in servicing the airplane, the serviceman noticed the tires were pretty worn. He not only suggested that I change them but he also sold me a set of tires. Oftentimes, the serviceman can sell the pilot things that his airplane needs . . . a polish job, parts, etc.

"As far as maintenance is concerned, during the six years I was with Riss & Company, we spent many thousands of dollars on major maintenance away from our home base. The reason we did was that the home-base operator did not stock spare parts and we didn't like to tie our airplane up so long. By going to a fixed-base operator, we'd get the whole job done in three or four days. If the aircraft needed a part, the service operator had it. If we had the work done at the home base, they'd get the airplane torn down, then would have to order the parts and the airplane'd sit there until the parts finally came in."

Wiley R. Wright: *"Do most corporations have their own maintenance personnel or is that service brought from the fixed-base?"*

Fixed-base Service Preferred

Cole H. Morrow: "There are a number of corporations that provide their own complete maintenance facilities. Where the business fleet is very large, this is practical and realistic because the volume of business justifies it. In the main, however, most corporations buy their maintenance services. In those cases where a company does not operate a fleet of sufficient size to justify its own maintenance facilities but is doing it anyway, it is usually out of desperation so as to insure availability of the airplane and also to get the quality of maintenance required. If satisfactory service were made available, I believe they would be much better off from an over-all cost standpoint to dispense with their own facilities and buy from the fixed-base operator.

"There is an ever-increasing recognition of the need for improvement in the efficiency of business-plane operation and, as that develops, the number of companies providing their own maintenance services will decrease in relation to the improved availability of com-

(Continued on page 44)

Daffy-nitions

Chief Pilot: A fellow who sits at a desk and tries to recall what flying was like.

Stewardess: An appetite with paint on it.

Hy Sheridan

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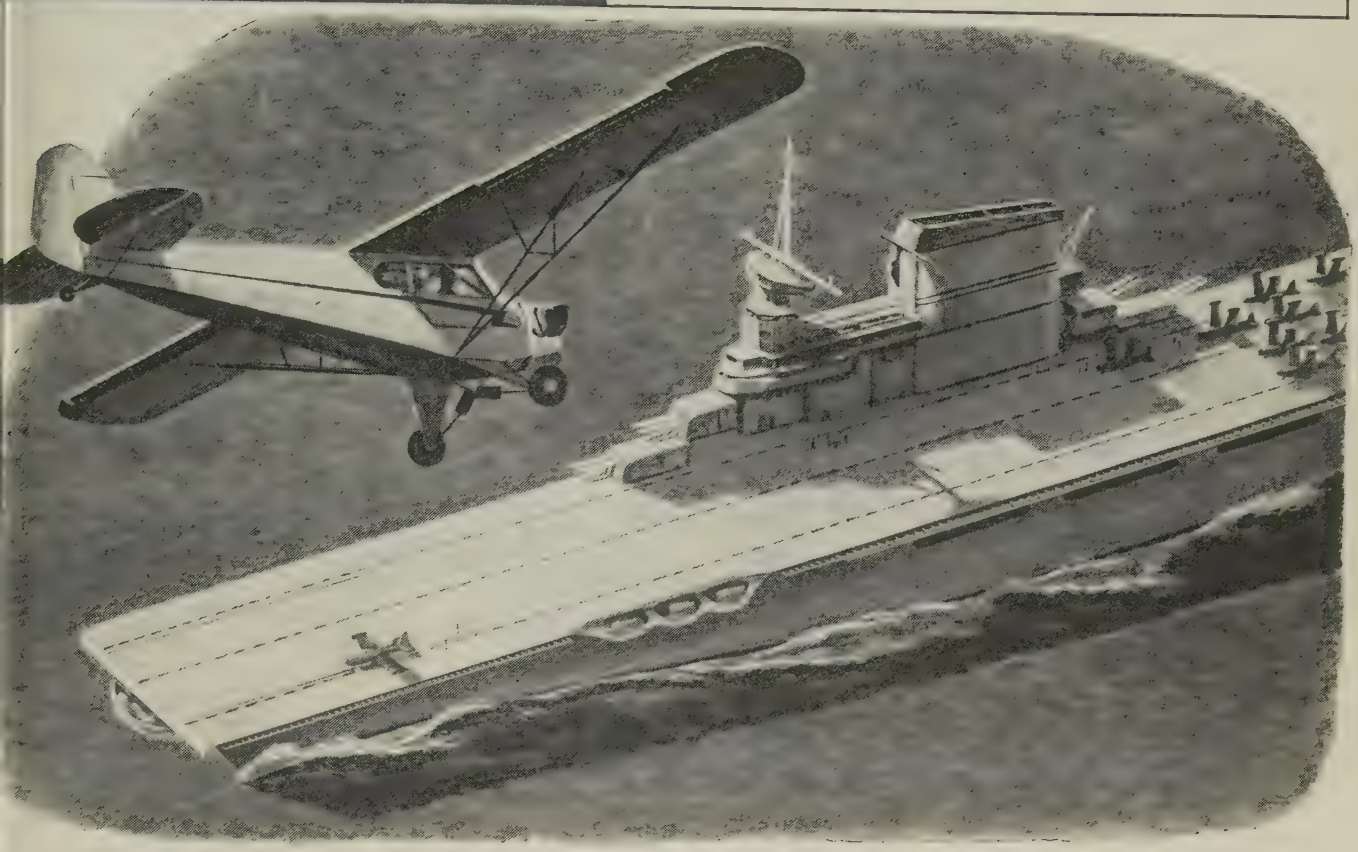

This Flier Shoots The Fleet

Attack from the air! When Navy ships come into San Diego harbor, this Piper flies out to shoot each one—with an aerial camera. George Barber, flier-photographer for Jack Davidson Photo's, has to be ready to go up any time between sunrise and sunset, and his Piper has to be ready, too. That's why he depends on quality Standard Aviation products and skilled service to keep his plane in top shape.

Mr. Davidson says, "We have always used Chevron Aviation Gasoline and RPM Aviation Oil, and have never had any engine trouble. Chevron Aviation Gasoline has ended detonation on take-offs, a trouble we experienced when we chartered a plane for our flights."

"Our plane takes a lot of abuse, with many take-offs on cold, short hops. RPM Aviation Oil has kept it running as good as new. And we really appreciate the service we get from Howard Fisher, our Standard dealer at Lindbergh Field. No matter what hour we have to fly, he always has our plane gassed, checked, cleaned and warmed up for us. Standard's quality products and service take the worry out of flying."

T.M.'S "RPM", "CHEVRON," REG. U.S. PAT. OFF.

TIP OF THE MONTH

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CHEVRON AVIATION GASOLINE

NEW RPM AVIATION OIL

STANDARD OIL COMPANY OF CALIFORNIA

Skyways Round Table

(Continued from page 42)

petent service by fixed-base operators."

Wiley R. Wright: *"In the majority of cases, then, corporate-aircraft owners have their maintenance work done by fixed-base operators on a contract basis. That being so, is there not a tremendous potential in keeping corporation personnel competently advised as to time for checks, oil changes, etc.?"*

Richard R. Washburn: "That's quite true, but the potential is not necessarily in the present owners but is in the future utility of aircraft by *numbers* of owners. As far as corporations maintaining their own aircraft is concerned, let's remember that we have only 1800 multi-engine aircraft in general company use around the country. Of that 1800, some of the larger corporations own the lion's share; some of them have as many as 10 or 15 multi-engine aircraft. Just as soon as they go into a maintenance program of their own, they've skimmed the cream of this 1800 off the potential of the fixed-base operator. Therefore, we end up with the maintenance for the companies that have one or two multi-engine aircraft or one or two single-engine planes. The people who are spending the heavy money in maintenance and who own the aircraft that represent the largest investment, spend more than 50% of the maintenance dollars that the fixed-base operator does not get. Even if the operator got every maintenance and service dollar spent, on the basis of 3,000 operators that would give an average of only $33,000 a year per operator, and our payroll alone is three times that."

Profit aside from Service

Louis R. Inwood: "Going back to other potential profit sources open to the fixed-base operators, perhaps we ought to take a look at what they did at the Pittsburgh Airport. They put in some hotel rooms, and in short order the majority of them were rented by the year by corporations using the Pittsburgh Airport. The rooms were rented for meetings, for overnight stops by their people, etc.

"Perhaps we'd better take a look at our chief competitor, highway transportation, for some ideas. There are many salesmen driving cars along the dangerous and busy highways who could do a better job by air. These travelers have an Association of Motor Courts furnishing them top service. Whenever they see their sign, automobile travelers have a tendency to stop at the places displaying that sign because they know it stands for quality service. Purely as a suggestion, it seems to me it would be a good idea to have the better fixed-base operators, the company-plane users and their association get together and put out a list of so-called blue-ribbon fixed-base operators. There might develop profit opportunities over and above mechanical repair and the sale of gasoline which would not in themselves be sufficient to sustain a big fixed-base operation. Certainly, the added potential would help pay the overhead.

"Wiley, don't you think that if we can start a 'blue-ribbon' service throughout the United States, we might achieve an additional profit potential for fixed-base operators?"

Wiley R. Wright: *"Very definitely. In my opinion there is a demand for something of that nature.*

"A few years ago, one of the most outstanding small airports in the U. S. was Bradley Field in Boise, Idaho. I don't know how it is now, because I haven't been out there in a long time, but at that time it had a restaurant, wonderful motel service, meeting rooms, playgrounds for the kids and even automobiles. All those things would come under the heading of service."

CONVERTED *for business use, this LB-30 owned by Continental Can Co. has nose baggage compartment, here being opened by Mech. Wayne Stamp.*

Richard R. Washburn: "Gentlemen, I'm firmly convinced there are plenty of opportunities for profit in the aviation industry and particularly in the fixed-base segment. As I reported, we've been engaged in it for five years and it has been profitable. If I may, I'd like to outline the type of program that we have followed in our own operation, and if it will do anyone else any good to come along that same road, we're certainly more than willing to put up the signboards we have used, so that operators in other parts of the country may use them.

"We started out with a very small operation and built it step by step so that we now have nine departments within our company. We have a Service Department, a Maintenance Department, a Parts Department, a Radio Department, a Flight Department, an Automotive Department, an Aircraft Sales Department, and of course, such others as Accounting, etc. Our company has been departmentalized for ease of handling administratively. We have tried to tap every phase of aviation from an income standpoint. We have an Avis-U-Drive-It franchise. If a man gets in and the weather is bad or there is no airport where he wants to go, we have an automobile waiting at the airport gate so he can climb in and continue his trip at a reasonable cost. If he gets off the airline and wants to go on down to Camden, S. C., where there is no airline service, we put him on an airplane and take him. If the weather goes bad again and the airlines are all cancelling and the private planes can't fly, we have an ICC franchise which allows us to give surface transportation in chartered automobiles. We load up the people and haul them all over.

"As I mentioned earlier, the hotel situation at our end of the country is pretty critical; it's hard to get reservations. So we maintain rooms at the local hotels. When you come into our operations, there always is a room available for you. You don't even have to register; we put it right on your bill for the services to the aircraft. Actually, the thing that has allowed us to do all this has been our aircraft sales. The profit of our operation is tied in very closely with aircraft sales and we frankly couldn't offer these other services without having sold a number of aircraft to the people in the Charlotte area. That's why I made the statement awhile ago that what we have to do is create a greater potential within our industry by increasing our aircraft sales. You can't maintain airplanes that aren't there; you can't pour gasoline into them if they haven't been sold."

Pilot Complaints

Jean H. DuBuque: "Every week a number of CAOA member-pilots and many non-member pilots stop in at our headquarters to discuss mutual business-flying problems. Invariably, the subject of airport service arises. The majority of pilots complain about the poor service and inadequate maintenance at many airports around the country. Some of them report that when they land on a field and taxi up the ramp, the serviceman makes no effort to approach the airplane. He just stands there. The pilots have to ask him to service their aircraft; they have to phone for a taxicab to take them into town. That's poor business practice and discourtesy. Could you blame a pilot if he did not go back to that particular airport for service? He'd prefer to fly 50 miles out of his way to a place where service is quickly and efficiently given.

"One example of excellent service may be found at the International Airport at Nogales, Arizona. The chief pilot of a leading member-company recently flew his company's president and members of the staff to Mexico on a business trip. The airport manager at Nogales personally came out to the airplane saw to it the group was escorted to the restaurant, had the service attendants at the airport promptly take care of the plane, refuel it wipe the windshields, etc. The visiting businessmen had their lunch, cleared customs

(Continued on page 46)

Skyways Round Table

(Continued from page 44)

and were out of the airport enroute to Mexico in 45 minutes! I believe that's a record."

Wiley R. Wright: *I think I can add something to that, Jean. Earlier today I talked with a man who's been flying for about 15 years and he's been in practically every state in the U.S. He reported he had yet to have someone tell him, 'I just checked your oil.... it's dirty and needs changing.' No serviceman has ever checked fuel and oil without first having been asked to."*

Richard R. Washburn: "I'd like to repeat one of my previous points along that line. Remember that your executive pilot flying these airplanes is a professional man. He has a professional standing and he earns a professional man's salary. I imagine the minimum pay for a company pilot is not under $400 a month and can go as high as $1,000 or $1200 a month. In this discussion of service, you are contrasting that professional man with a man doing a filling-station job and you're demanding something of that filling-station man that you are getting only through your professional man.

"We at Southern Flight Service have instituted a training program for the servicemen in our operation, but you aren't going to change human nature. You aren't going to get the same working enthusiasm for a job that pays what the serviceman's job pays as you get from the well-paid professional man. You can't afford to pay a serviceman $400 a month to pour gasoline and clean off windshields; and until you can, you aren't going to get from that serviceman the initiative that will produce the service you desire."

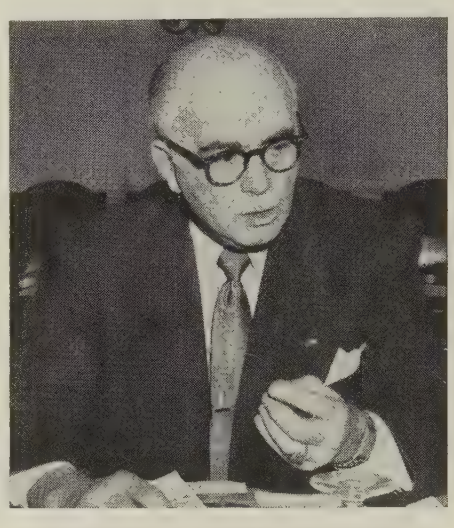
Jean H. DuBuque: "That's no excuse for indifference or discourtesy."

Richard R. Washburn: "That's true. You might stop at Southern Flight Service one day and run into one of my servicemen who is indifferent and discourteous, and I might replace him. I'll bet I'll go through 15 before I can find one that's okay, and when we do, he won't be a serviceman long, because he will advance up the company ladder. We have a higher turnover in service personnel than in any other department. We hire and fire them by the droves, and we've found about two out of the last 30 that are worth a darn."

Virgil W. Hackett: "Getting back to what Jean gave us as an outstanding example, where the fixed-base operator himself comes out to meet the plane. All of us who are in business have done that from time to time, but in a 24-hour day, seven days a week, somebody sometime is going to come into the airport and meet one of our indifferent servicemen. If there isn't some measure of tolerance on the part of the company pilot, he just doesn't come back. That's the thing Mr. Washburn is talking about."

Louis R. Inwood: "I'm quite familiar with the situation at Nogales, and Jean DuBuque picked a good one, because Nogales does not do too much business. They do a fair amount of business, but not a lot, and it's a distinct pleasure for the airport manager at Nogales to go out and greet and meet the few customers that come in. There's a lot of difference between Nogales and Kansas City, St. Louis, Charlotte, and other airports.

"But I do think Jean has a point there. We are all striving for service. I don't think there's an airport or a fixed-base operator that isn't trying to deliver it. But some of us are having a pretty tough time, what with labor turnover, etc. Perhaps one solution would be to have the manager's office situated so that he could view the operations of his employees as he conducts his other work."



"OPERATOR who is energetic and alert will provide the services that have been indicated in this SKYWAYS Round Table discussion," reported Moderator Wiley Wright of the CAA

Richard R. Washburn: "Aviation is comparatively new and, consequently, most of the financial institutions in the country are just now beginning to be receptive to aviation investments. The average fixed-base operator has a problem getting together enough capital to carry forward his operation. Perhaps some method could be devised whereby financial backing could be had that would enable the operator to give the type of service, carry the inventory and maintain the type of operation that is needed. It's been my experience that throughout this whole fixed-base segment we've got a lot of good pilots but few businessmen. It's because of that, that banks and lending agencies have shied away from aviation."

Cole H. Morrow: "There's one other thing that I would like to point out that hasn't been touched upon. It's one of our requirements and it's also one more way to draw business to your airport. As a substitute for hotel facilities downtown, why not establish Skytel facilities at the airport. In the future, with the smaller type aircraft being flown by the salesman himself and with automobile rental facilities available at the airport, a number of people will be saying, 'Well, I want to be sure to get on over to such-and-such a place because they have a motel right on the airport. I'll spend the night there and rent a car and make my calls first thing in the morning.'

"Not only would that appeal to the pilot-businessman but it would also appeal to the businessmen with their professional pilots. The experience at Pittsburgh with its hotel on the field has shown what can be done in that direction."

Summary

Wiley R. Wright: *"Well, gentlemen, we have listened to the needs of those who operate business aircraft and we have been told what services can be rendered by the fixed-base operator. If that operator is energetic and alert, he'll provide the services that have been indicated here in this discussion:*

1. *Prompt and efficient aircraft service—gas, oil, etc.*
2. *Quality maintenance work.*
3. *Clean restaurant or snack bar that serves good food.*
4. *Comfortable quarters with available magazines, newspapers, vending machines where permissible, or some form of entertainment where there is a wait while maintenance work is being done.*
5. *Observation deck where people can sit and watch what is going on at the field.*
6. *Parking lots.*
7. *Public address system. A call might come in for someone and a public address system for paging would be of benefit to the flying public.*
8. *A pay telephone made available.*
9. *An auto rental. This is very necessary for the type of operation that we are conducting today.*

"These are a few of the essential things that should be available and which would insure the return of the visiting plane.

"Another suggestion, and a good one, was for the development of a directory which would indicate the best operations around the country and what ordinary or special services were available at these fields.

"Someone else suggested a motel on the field or a tie-in with local hotels so that rooms would be available for those who RON'd at the field. I understand, too, that a few years ago SKYWAYS developed its 'Skytel' designs for construction on airports so that visiting pilots and/or businessmen would have quarters for overnight stops just as automobile-traveling businessmen have via highway motels.

"There are many activities that fixed-base operators could get into that would be profit opportunities for them and also would be answers to service problems for the users of business aircraft, and which would do much to encourage the growth of this important segment of air transportation.

"Perhaps, through discussions of this type, the way will be opened for greater profit, financially and service-wise, for everyone—pilot and service operator alike."

Electric Fuel Pump

(Continued from page 25)

13 ozs.) of the pump is particularly attractive in the aircraft field. Pump discharge pressure may be varied through the range from 3 lbs. per square inch to 7 lbs. per square inch by the choice of plunger springs. The Bendix electric fuel pump is said to surpass all pumps of its size classification—it can deliver more than 30 gallons per hour. When operating at full delivery, a maximum power requirement of 7 watts is reached. Mounted vertically, the normal no-delivery pressure at the pump is $4\frac{1}{2} \pm \frac{1}{4}$ lbs. per square inch. If the pump is mounted horizontally, the pressure increases approximately one-half pound and if mounted upside down, the pressure increases approximately one pound.

When needed, two or more pumps can be used in parallel for greater output, while higher pressures can be obtained by mounting two or more pumps in series.

The pump is very easy to install and to service. The only service normally needed is to clean the screen in the pump inlet chamber so that an adequate flow of fuel may be transmitted through the screen.

Installation

The mounting bracket is an integral part of the pump and serves as the ground connection for the electrical circuit. The bracket is so designed that the pump may be advantageously mounted in nearly any location. Remove paint or other non-conductors from the area adjacent to the mounting holes in the bracket and in structure. This insures the pump being well grounded. There may be cases where "telegraphing" of the pump pulses is annoying. This objection may be overcome by use of a rubber mounting for the pump and short flexible fuel lines (approximately six inches long) between the pump and the main fuel lines. A ground-wire connection between the pump and the installation frame must then be used to insure a good electrical ground. Connect the ground wire, at the pump end, underneath one of the mounting bolts. Pump mounting holes permit use of one-quarter inch diameter bolts.

The model number, voltage and ground polarity appear on the name-plate; voltage and ground polarity are also stamped on the mounting bracket *(see Outline Drawing)*. Early production models were stamped with a (+) or (—) symbol. Subsequent models are stamped "POS" or "NEG". The voltage and ground polarity of the pump must be identical to that of the installation. Thus a 12-volt, negative-grounded battery system demands a 12-volt negative-ground model of pump. These details must be carefully observed in each application.

The accompanying Outline Drawing also shows all of the important mounting dimensions and space requirements. Nominal tubing for fuel lines will be 5/16 inch or $\frac{3}{8}$ inch O.D., depending upon fuel-delivery requirements and the general installation. The pump ports are tapped $\frac{1}{8}$-27 pipe thread. Avoid sharp kinks or other restrictions in the lines, which will tend to reduce the fuel flow.

It may be necessary, in some installations, to install a condenser for radio suppression if the electric fuel pump operation causes radio noise. A condenser from 0.1 to 0.5 mfd may be used, depending on what size is necessary to eliminate the noise. The matter of suppressing radio noise, due to variation in circumstances, may make it necessary to try different condensers in different locations, until the desired results are obtained. All military models of the pump include a special radio suppressor to prevent radio interference at extremely high frequencies.

Applications

Thus far, aircraft application of the Bendix electric fuel pump has centered around its use in supplying fuel to combustion heaters. Several of the large airlines in the country are using the pump for cabin heaters and are achieving outstanding results with regard to economical first cost, long service life, and reliability of operation. Two pumps are used in parallel and particular advantages cited are: pump automatically cycles at a rate that is directly proportional to heater demand—does not return fuel to source; in event one pump fails, the other can keep the heater at 70% to 75% of its output. Considering the wide range of combustion heaters available for cabin heating and other purposes, the electric fuel pump would seem to offer attractive advantages for this and other applications aboard executive aircraft.

The pump has also been used to supply fuel to personnel and engine heaters on the ground and in all types of military vehicles. Although one usually thinks of a fuel pump as being used for pumping fuel, the air-conditioning companies have been using the pump to pump water for cooling aircraft cabins. When pumping water, a stainless steel plunger is provided in order to avoid corrosion difficulties.

The Bendix pump is being used today to supply carburetors on military and commercial trucks, busses, and passenger cars. It would seem as if this compact, lightweight, dependable fuel pump has uses never before explored in the automotive pumping field. In addition to those mentioned, there may be found applications where diesel oil, kerosenes, chemicals, very hot lubricating oils and coolants are being pumped. The relatively small amount of delivery required by these users makes the Bendix electric fuel pump a natural for a great many pumping jobs.

It is interesting to note that though the Bendix electric fuel pump was first designed with automotive fuel systems in mind, its uses have become more universal. With the engineering principle now proven, it is felt that many more applications of these principles may be expected.

Flying the Hydro-Ski

(Continued from page 15)

abruptly until the hull hit the water. By that time the pilot had the yoke full back and we came up so fast that the whole airplane was airborne before bouncing back on the ski and accelerating on up to getaway speed. Such a maneuver is not to be recommended as it might not always produce similar results, but it does serve to give you a little more confidence.

Hydro-skis fall into two basic categories and have two basic applications. In one case you apply them to the existing landplane gear of a landplane that has no means of static flotation; and in the other case you use them in conjunction with a buoyant body, such as a seaplane hull. Actually, in the latter case it is not necessarily required that the fuselage body have hull lines as was the case with the JRF. The real pay-off accrues to the application where you design the fuselage for aerodynamic efficiency making the structure water-tight. You would, of course, use a high or mid-wing and, assuming a jet aircraft, locate the inlet ducts so as to be protected from spray. The skis would be retractable—like wheels—so that once airborne you have a water-based airplane with the performance capabilities of a landplane.

With the ordinary non-buoyant landplane, the same is true when airborne. The big gain, however, is that you don't have to make the fuselage structure water-tight; you're not obligated to locate your wings at a specific elevation, and you haven't an inlet or powerplant location problem. Actually, you do just what All American Engineering Corporation did—take a landplane, put special universal surface planing ski gear (complete with wheels) on the landing gear strut ends and you're ready to take off on water, ice, snow, mud or concrete runway.

In flight you would retract them! After landing and before take-off, you must maintain sufficient water speed to obtain adequate planing lift; you can't close the throttle and put over a fish line until you first run up on a beach, but that's about the only restriction there is to use of a ski-equipped plane.

Piloting Technique

The respective piloting technique in either case becomes basically identical at planing speeds, and at these speeds during take-off and landing you handle either craft with just about the same technique as you would use with a hull seaplane or floatplane. At high speeds in take-off you stay above the trim angles of attack that would produce low-angle porpoising and below the trim angles wherein high-angle porpoise might be expected. During landing the procedure is to avoid very low-angle, high-speed contacts and generally lean toward the high-trim, nearly full-stall landing contact.

The technique employed to become ski-borne in take-off and to terminate the landing after contact is quite different with the two ski applications. After launching, with the submersible hydro-ski used with a buoyant fuselage or hull aircraft, you taxi to your point of take-off while running through your cockpit check. Picking up tower clearance and then squaring away for take-off, you "pour on the coal". What happens after that until you're planing depends a lot on the configuration that's involved.

The Edo-type of hydro-ski functions very much like a submerged airfoil until it surfaces. The upper surface is cambered to develop lift in exactly the same manner as an airplane wing. Actually, the ski being long and somewhat narrow, it fails to produce hydrofoil lift very efficiently since it has extremely low aspect ratio. Water, however, is some 800 times more dense than air; thus even an inefficient hydrofoil develops tremendous lift effectiveness so that the airplane is borne up out of the water with an almost explosive force. The rate of rise, *i.e.*, vertical travel upwards of the ski-borne airplane, is quite amazing. Note the photo sequence where hydro-ski lift *(page 15)* was deliberately developed to its maximum degree, then released so as to literally throw the airplane into flight in less than two seconds, with the airplane moving vertically more than two feet. In a normal take-off, the transition is less abrupt and the ski runs on the surface for a period of time roughly equal to the time that it runs submerged.

The piloting trick has been to keep the ski submerged until sufficient speed has been obtained to support the airplane by planing action alone. There has been a gap of from 5 to 8 mph between the minimum speed at which the ski develops enough "hydrofoil lift effectiveness" to carry the airplane up clear of the water and surface the ski, and that speed where the ski would stall out on the water and submerge. It is necessary to use enough down elevator to hold the skis submerged until minimum speed for planing has been reached. If you force the skis to run submerged until you have reached the maximum speed at which they will run submerged without cavitation (cavitation is the hydrodynamic counterpart of compressibility), the skis will have developed their peak submerged lift effectiveness. With the JRF-5 twin-ski *Goose* this speed was between 75% and 80% of getaway and with a little wind you can leap into flight without planing as shown in the photo sequence. After landing, you just run out and let the skis water-stall and submerge. The water-stall is table and requires no technique nor special attitude for stability during the process.

With the landplane type on planing skis, the take-off begins and the landing ends on a ramp, a beach or other solid surface. Once you head for the water, you should be ready to go all the way through take-off. After landing, you've got to run back or up on to the ramp or beach before you consider the

(Continued on page 50)

NAVY SNJ *was equipped with hydro-skis by All American Engin. under Navy Bureau of Aeronautics contract. Wheels were an integral part of this installation, allowing the SNJ to roll up on a beach or ramp and also permitting its operation from a grass strip*

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ask Ted Pavell

Chief Pilot, Allied Stores Corp., New York City

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"That's been our pleasant experience with Gulf Aviation Products for the last six years."

Chief Pilot Pavell at the controls of the DC-3 owned by Allied Stores Corp., operators of well-known department stores throughout the nation.

For radial engines, or where a detergent oil is not desired, Gulf Aircraft Engine Oil, Series-R is a top-quality, non-detergent, straight mineral lubricating oil—approved by Pratt & Whitney and other radial engine manufacturers for all types of service. It retards sludge and carbon formation and retains its body at high operating temperatures.

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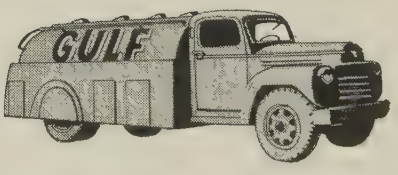

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Flying the Hydro-Ski

(Continued from page 48)

maneuver complete. There's no problem in either case since ski-planes to date have enjoyed unusually good planing-speed maneuverability. The resistance is very low so the power required is moderate. You can, therefore, taxi at planing speed almost any reasonable distance to reach a desired take-off lane or terminate a landing.

The principal trick is to get just enough speed before you reach too great a water depth. In the case of the ramp launching, you spot the plane far enough from the water to accelerate to minimum planing water speed by the time you reach the water. It is normally good technique to initiate your run diagonally across the ramp to take advantage of a more shallow slope than a straight-in run would allow. It is desirable to enter the water at an optimum speed since too much speed will set off bouncing.

The beach launching is basically identical except that a straight-in run is usually impractical due to the higher rolling and sliding resistance enroute to the water and by the fact that beaches inherently provide the ideal means for launching—a long parallel run at the water's edge or just out from the edge. Shallow water greatly increases the lift and lowers the water stalling speed. Once you reach a little more than minimum planing speed, you either continue your take-off or turn to a more favorable heading in respect to the wind.

Beaching

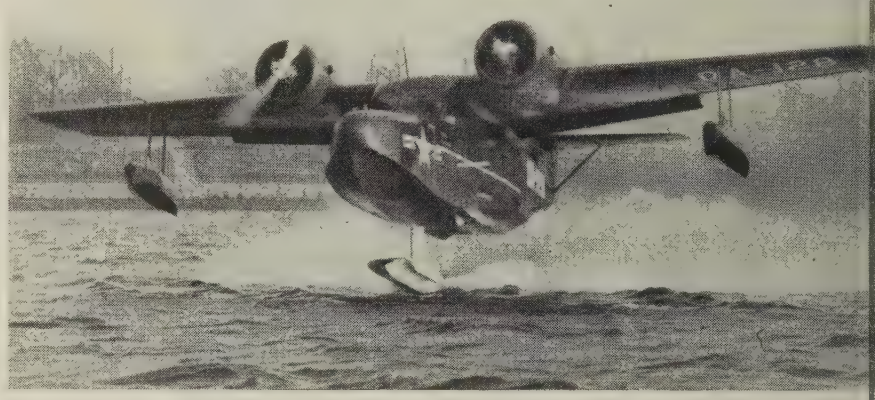
If you are going to beach on a ramp after landing, you plan your run out to facilitate your planing approach and contact to the ramp. Where winds are strong you may have to land away from the ramp or beach, complete a 180 and taxi back at planing speeds. Ramp contacts are usually straight in.

Beach contacts are usually handled by landing almost parallel to the beach, then running onto the beach at a slight angle. Except under high-wind conditions, you should generally be able to stick to this procedure. Hydro-skis, whether attached to a landplane or a hull, make a very good crosswind landing gear.

One thing to establish clearly here: Minimum planing speed is usually not a high figure, particularly in shallow water. It's a function of ski loading, of course, but a reasonably small plan form, such as used in All American's installations, gives water-stall speeds around 10 mph for lightplanes and around 20 mph for heavier types. The Edo ski on the JRF was much more heavily loaded in order to lower impact loads in rough water with the water stall in deep water occurring about 30 mph. Remember it's "water speed" that counts. There is a wind effect, of course, but if you know your calm-air water stall speed and have a means for ascertaining water speed, that's all you need.

There are probably two basic questions relative to hydro-skis and the probability for their use on personal and commercial airplane types. The question of "how" is answered in principle by what has already been done in the field and is currently being developed. Hull-type seaplanes can quite readily be fitted with retractable hydro-skis to extend their rough-water operating capability and provide for their varied surface operation in much the same way that they have been fitted for snow and ice operations, but the skis and their installation must incorporate necessary hydrodynamic features for water basing.

The primary question may very well be "why"? The hull-type seaplane can be expected to operate under rough-water conditions 100% more severe when equipped with ski gear than current commercial hull designs would permit. Further, with this hydro-ski gear the airplane can operate ideally from snow, ice, sod, etc., and carry its own beaching and ground handling gear by having wheels incorporated within the skis.



EDO-TYPE *hydro-ski functions much like submerged airfoil until it surfaces. Upper face is cambered to develop lift in same manner as airplane wing. In water it dev tremendous lift effectiveness so that airplane is borne up out of water with explosive*

The most plausible reason for using hydro-skis on civil landplane types would be to extend their utility for business flying. There exists many ideally suited remote lakes, rivers and other water areas which would be destinations of interest to sportsmen and other pilots for business and recreational purposes. Many personal-plane owners have landplanes and, either for reasons of cost or a desire to continue airport basing, do not wish to convert to a floatplane configuration on either a seasonal or permanent basis. Hydro-skis would allow a less expensive and less permanent conversion. While "converted" to an omniphibious configuration, they would still retain their airport-basing capability.

There are still many other cases where an airplane lacks its full potential for real utility because it lacks the ability to handle a combination of several different types of surfaces that might be encountered during the course of a given flight. The varied surface hydro-ski plane can readily and efficiently fly and operate from water, snow, ice, sod, mud flats, etc., while still being capable of surfaced airport operation. Such versa has principal utility in the more remote undeveloped areas.

In principle hydro-skis give personal craft types somewhat similar versatilit their basing as is inherently enjoye rotary wing aircraft. Of course, more b area is required for fixed-wing types lightplanes make modest demands on tances for take-off and landing, and onc borne the simplication, low acquisition maintenance cost pay off.

It is quite difficult to predict "when" sonal and commercial aircraft might b pected to begin taking widespread adva of the tremendous potentiality now ava through the use of hydro-skis. The hull airplane operator can undoubtedly such a modification made without faci licensing problem since, other than a w increase, there would occur no restric

In the case of the personal and comm landplane type, the writer is currently formed as to the position of the CAA. clear that pilot error can result in an vertent "dunking", but the tests by All ican and the Navy have clearly shown such incidents are so infrequent as ignored. There exists so much succ progress in the development of infla flotation gear for rotary-wing aircraft it is obvious that lightweight emer flotation gear could be readily and pensively provided.

I think the "when" might very wel velop to be surprisingly soon. There has and is tremendous progress in research development of all applications of hydr and it seems inconceivable that comm and personal aircraft types would fail to exploit what, in the estimation of many, only *really* new thing that has happen water flying since it began!

BLOOD doesn't grow on TREES

Neither can you dig it up out of a mine in the ground. Human blood is manufactured in only one place—the human body.

Vast quantities of blood are needed—urgently needed—to help save the lives of the men wounded in combat, and of the hurt and sick in hospitals at home. Blood is also needed to produce gamma globulin, the new serum that promises to do much to protect children from polio and measles.

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Isn't it worthwhile to take a few minutes time to save a human life? Give blood—keep on giving blood. How? Call your Red Cross, Armed Forces or Community Blood Donor Center today!

GIVE BLOOD

...give it again and again

NATIONAL BLOOD PROGRAM

Radar Trainer

(Continued from page 13)

over on a training mission is represented by a special terrain contour map, made to the scale of 1/200,000. This map is placed in a shallow tank of water so that ultrasonic waves can be reflected from it. The map itself measures about 6 x 10 feet, so that a very sizable area is represented in a very small amount of space.

The electromagnetic radar set of a bomber has its counterpart in an ultrasonic transmitting and receiving device which is suspended above the map from a precisely machined "simplane", capable of moving in three directions simultaneously. Geared to the same key ratio as the map, the simplane travels at 1/200,000ths of the speed being simulated for the mission. It accurately reproduces a plane's flight not only forward but also sideward and up and down, simulating forward speeds as high as 1200 knots. Because of its greatly reduced speed, however, the simplane itself travels very slowly—so slowly, that its lateral and vertical motion is imperceptible and its forward motion is just barely visible to the naked eye.

Meanwhile, the scanner, which is submerged in the water in the tank at a variable height above the map, continually sends out ultrasonic waves to "view" the map. Since these waves behave the same as electromagnetic waves in air in all respects except speed, they reproduce on the trainer's radarscopes the same picture that would appear during an actual mission.

The radarscopes which are used by the trainees are connected electronically with the simplane and installed in remotely located booths. Two such booths are provided in the trainer—one for the navigator and one for the bombardier. Each is an exact replica of an actual aircraft station, with the proper instrument panel. Thus, the trainees are thoroughly familiarized with all the conditions that they would meet on an actual flight.

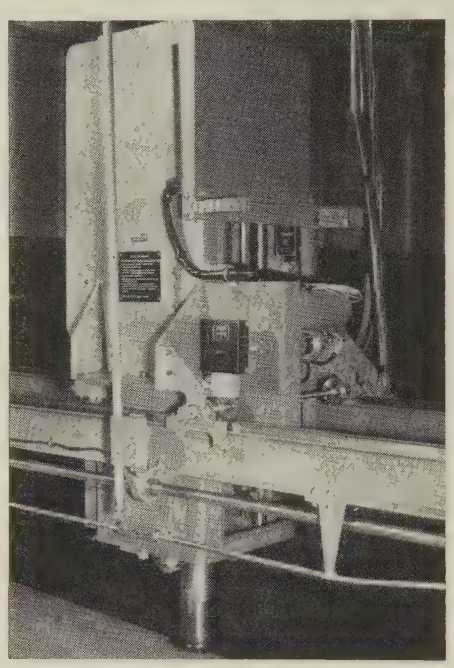
The "flight" of the simplane is controlled by an instructor, who is stationed at a large panel from which hundreds of electrical connections are made to the simplane. On this panel the instructor has all the controls needed to fly a plane. By turning dials, he takes the plane off and completely controls its flight during the entire training mission, except during the bomb run.

With his controls the instructor can simulate all conceivable flight conditions. Not only does he determine such factors as rate of climb, altitude, speed, turn and bank, and wind conditions, but he can change any of these factors at will during the flight. He can also introduce friendly beacon signals and even create such complications as radar jamming and interference from other radar sets.

To practice a bombing mission, navigator and bombardier (now referred to as "Air Observers" by the Air Force) are briefed as to target and course, and sent on their way by the instructor. The navigator plots his predetermined course from the information conveyed by his radarscope and instruments. Approaching the target, the bombardier takes over control of the course. At his station is a visual bombing simulator, in which a realistic ground picture is produced by a modified optical bombsight. Using it, he picks his spot and, finally, releases his bombs.

During the entire flight, the instructor is kept informed, by means of two recording boards, of how accurately the trainees are performing their mission. One of the boards represents the same area as the map in the tank, though just half its size, and records the course the navigator plots. This enables the instructor to help the navigator correct any errors during the flight, and also gives him a permanent record so that he and the navigator can compare the actual course plotted with that which the instructor has designated.

The second board records the bombardier's performance. First, it records the flight path



SIMPLANE *of APQ-T1 is mounted on rails. Note the radar scanner suspended below it*

of the plane from the moment the bombardier takes over control of the flight in the region of the bombing operation. Then, when the bombardier presses the bomb-release button, the trainer automatically computes the path a bomb would take if dropped at that point, and the board plots this path—from the point at which the bomb is released to its point of impact.

Two models of the trainer have been produced. The APQ-T1 is a stationary model, established at Wright Patterson Air Force Base. A second smaller model, the APQ-T2, is made specifically for air shipment, so that it can be moved quickly and easily from base to base in this country and overseas. This weighs about 25,000 pounds and can be disassembled and packed into 22 boxes. No special crate is needed for shipment, the boxes being made from parts of the trainer itself. For example, the walls and roof of the tank room form the tops of the boxes. The complete trainer can be assembled and taken down in a relatively short time with very simple tools.

Both models are highly complex machines with thousands of electrical connections and many intricate electronic computers. The APQ-T1 contains 375 vacuum tubes and 35 miles of wire. Built into it are such items of supplemental equipment as motor generators, intercommunicating phones, and an air-conditioning unit. Because it has a permanent housing, it is also provided with accurate controls over temperature and humidity. The APQ-T2 has 67 chassis, 320 vacuum tubes and over 20 miles of wire.

The type of ground training which the APQ-T1 and T2 provide offers numerous important advantages both to the trainees and to the taxpayers. In the first place, the trainees can become completely familiar with enemy terrain as it will appear to them, before they fly their first combat mission over it. Navigators and bombardiers already trained on the machine have shown consistently greater proficiency than those trained by other methods. Moreover, their training has been accomplished with absolute safety since, no matter how dire a mistake the trainees make, neither they nor their machine can be hurt. Then, too, the instructor is better able to monitor what his students do.

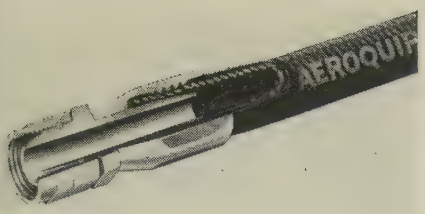
To the taxpayers, the original high cost of this complex training device is more than offset by the savings it effects. Not only are aircraft and flight personnel released for other important duties, but no fuel is consumed, no practice ammunition and bombs are used, no airplane maintenance is required, and no spare parts are needed for replacement. No hangar space is occupied. Finally a greater amount of training is possible in a given period of time, and training can be carried out on schedule, regardless of weather.

Speaking of the APQ-T1, Major General Donald L. Putt, Vice Commander of the Air Research and Development Command, explains: "This kind of highly specialized equipment which industry builds for us, is an immensely valuable aid in our expanding Air Force training program. It does a better job of training much more quickly; and at an enormous saving in money and resources."

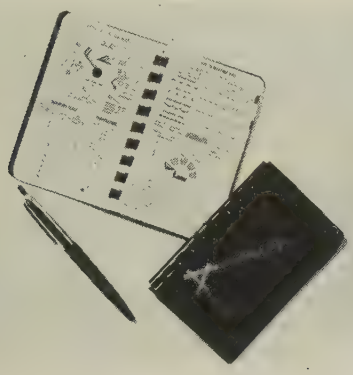
When airborne radar becomes standard equipment on our airliners, a trainer of this type will be equally valuable for training the radar operator. More and more, commercial airlines and pilots are seriously considering the installation of radar not only for use over mountainous terrain and during take-offs and landings during instrument weather, but also for the detection of storms.

To teach airline-radar operators, the trainer could be readily modified for commercial aviation's needs and save the airlines thousands of dollars in their training programs. Although simulation of storms on the trainer has not yet been achieved, it is believed that this, too, could be developed for airline use. The effects of clouds and wind are already being reproduced.

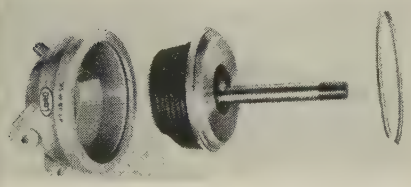
SKYWAYS reports
NEW PRODUCTS



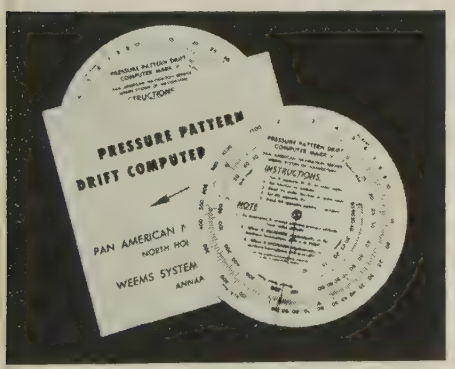
▲ A New Aeroquip "Globe-Seal" hose lines can be connected to Ermeto and Ferulok tube connectors without need for ferrules or inserts. Fitting consists of standard Aeroquip socket, new nipple. Single or double types are available.



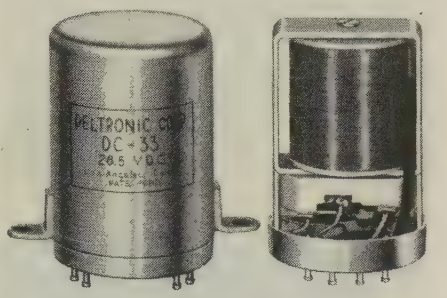
▲ B AIRTAB is pilot's flight planning notebook which includes weather symbols, navigation, radio information, notes on traffic control, etc. Space also provided for flight notes, addresses, phone numbers, note pad, etc. Nimbus, Inc.



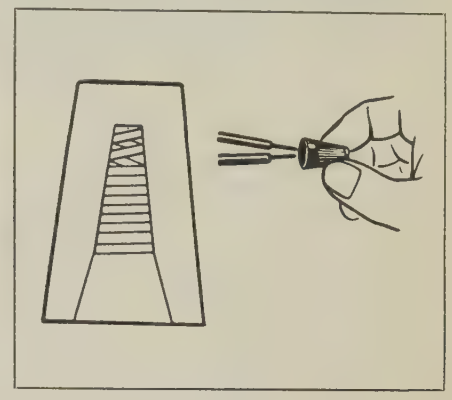
▲ C Lord Dynafocal engine mounting for R-2800-C engines is stronger, but weighs less than previous mountings; is interchangeable as to vibration characteristics, dimensions with 340, DC-6, etc. CAA approved. Lord Mfg.



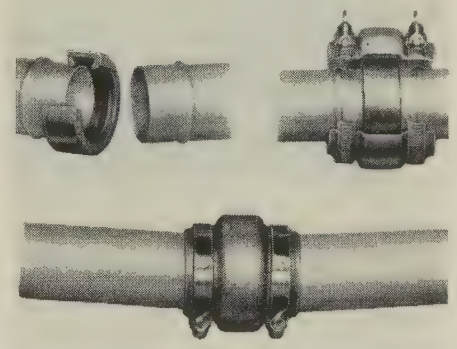
▲ D Computer determines aircraft drift by means of difference between absolute and pressure altitudes. This pocket-size Mark V computer is 4½ inches in diameter, weighs less than one ounce. Price is $2.50. Pan Am Navigation.



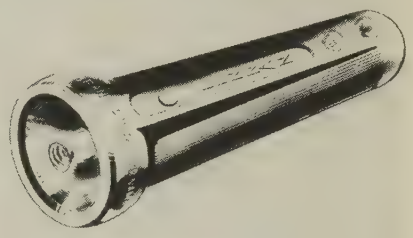
▲ E Hermetically sealed, double-pole double-throw DC relay of miniature size and low weight is available in quantity from Deltronic Corp. It weighs 3.62 ounces, exceeds service requirements of MIL-R-5757B specifications.



▲ G "Lok-on" is screw-on type connector consisting of Bakelite shell, cone-shaped metal spring insert. Magnified drawing shows "Lok-on" design. Spirals and metal insert flare out to lock the wires. Holub Industries, Inc.



▲ F New flexible fluid line connector for tubing provides leak-proof seal under extreme temperature ranges and pressures while allowing maximum misalignment up to 4°; reduces coupling weight up to 75%. Rubber Teck, Inc.



▲ H Lennan K-2 is explosion-proof, water, vapor and damage-proof flashlight. Its batteries are sealed in and air tight for longer life. Neoprene case resists deterioration from oil, gasoline, etc. Guaranteed for 3 years. Lennan Prod.

SKYWAYS reports NEW PRODUCTS
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Address.....

City.....State.....

Company.....Title or Position.....

8-53

Air Traffic Story

(Continued from page 19)

and defense values, making almost any investment seem modest in comparison to the cost of failure.

Makeshift navigation devices and experience, sometimes bitter or tragic, preceded science in the art of air navigation. John Wise, pre-Civil War balloon pioneer, learned that shouting for help in a fog didn't necessarily mean you got an answer—you might be hearing an echo of your own voice from a perilously close mountain side. Flyers in the early decades of the century picked their weather with exceeding care and navigated strictly by eye, sticking close to the point of take-off.

As aircraft were built for longer hops, a pilot navigated mostly by the seat of his pants, sixth sense, and prayer. Instruments were added gingerly and were seldom reliable. As late as the 20's, the famous airmail airplanes, the Curtis JN4H *Jenny* and the de-Havilland DH4M, had only two navigation instruments, an altimeter and a compass. Only the most casual efforts were made to give aid and comfort from the ground. Airports were few and far between. In 1921, Jack Knight completed the first night flight of airmail from North Platte, Nebraska, to Chicago, guided only by bonfires, red flares, an automobile road map, and legendary luck. Two years before, the Post Office Department had started research toward using radio in the cockpit at College Park, Maryland, but although "Father of the Airways" Charles I. Stanton and others had some success, radio navigation was a dream of the future, and even pilots looked on newfangled radio contraptions with jaundiced eyes.

Not until the decade of passenger air-transport development in the '30's did the big "Why's" justifying improved air navigation—public convenience and necessity, national defense, and the national economy—lead to serious study and progress in the field.

Long before World War II, it became evident that the airplane, if it could reach the goal of all-weather flight, was destined to become one of the most important factors in modern civilization. But if it could operate in fair weather only, the airplane was little more than an interesting novelty.

Transport-wise, this thesis had begun to prove out before the 1939-'45 conflict, when some effective steps were taken toward developing and establishing aids to air navigation. By 1927, both visual light beacons and a total of 17 LF/MF four-course radio ranges were working at widespread spots across the nation. The radio "marker beacon," experimental during the '20's, had taken its place at 89 spots along the airways by 1929. Radio communication between ground and aircraft was largely one-way and in code till 1930, when the pilot began to send messages by radiotelephone from the cockpit to ground stations. These devices, combined into an airways system, were adequate for their time.

Radio brought to the cockpit dot-and-dash navigation signals indicating a pilot's relation to a fixed course. Light beacons and terminal lighting were thoroughly adequate for guidance in good weather. Properly equipped, an aircraft could fly far more safely and frequently than ever before. Chances of getting lost were reduced to a minimum, and chances of getting to a destination were greatly improved.

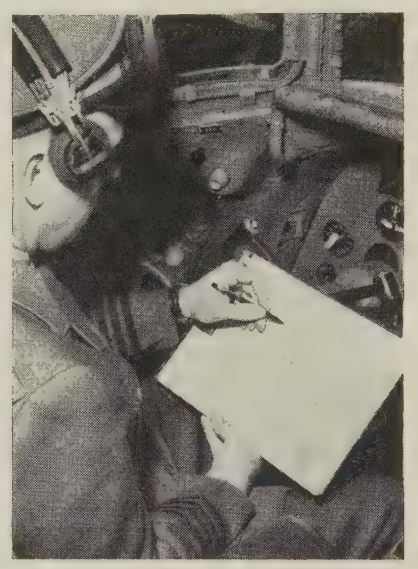
By 1939 there were 27,074 miles of airways implemented with facilities for radio navigation and communication. Control towers were in operation at 52 locations to control the aircraft on and in the vicinity of the airport, and 11 air route traffic control centers were in operation to control aircraft conducting instrument flight on the airways.

As the number of aircraft and airways increased, the system began to fail. This was because its contemporary needs had traveled a long way from its beginnings. In the Jack Knight days of the airmail, there was no necessity for handling more than one aircraft at a time, even at a terminal. The bulk of the equipment to direct flight on the airways was, therefore, not designed for mass traffic.

The navigation and communication equipment which was a part of the system in 1939 would be good to this day except for two major faults. In the first place, each LF/MF four-course radio range, as its name indicates, provided only four lanes or course lines. As traffic increased, the lack of aerial highways, especially around busy terminals, became more and more severe. Additional airways to relieve this situation could be provided only by installing additional LF/MF ranges. However, it was not always possible to accomplish this because of congestion in the radio-frequency band in which these aids operated. The second fault was that low frequency radio, which had been the best solution to the communications problem during the '20's and early '30's, began to show signs of breaking down under the crowded communication conditions of the '40's. The chief difficulty w static during stormy weather when commun cation was most needed. As the nation need super-highways with the increase in autom bile production, so were super-airways order with increased air traffic. Consequentl attention was directed to the very high rad frequencies (VHF) which more nearly m the new demands than the low/medium rad frequencies (LF/MF), serviceable as the la ter had been to the progress of aviation in development years.

Under normal conditions, the airwa would have improved gradually. World W II served as a tremendous stimulant to pro ress. On the one hand, airway equipment, o and new, was rushed into action. This broug opportunity to test some of the new devic On the other hand, during the conflict, furth development of the new equipment for nc military applications had to be stopped wh the nation concentrated on the war. The sult was that after VJ Day, the nation l came aware that new, better equipment w available for the airways, at the same tir finding itself far behind in its airways velopment. To laymen as well as profession it was evident that economic and nation security needs made it mandatory that t nation's airways be developed quickly and the fullest extent. Good airways had come as essential to the American way of li as good highways and railroad systems. Th were a natural resource, building the country economy in time of peace. In time of w they offered a means of moving military traffic as needed, plus a tremendous boost the production of the goods and munitio with which wars are won.

For civil aviation, it meant that shippe of perishable goods could bridge space time to market their cargoes, it meant th top-flight engineers and executives cou double and triple their productive time



THUNDERSTORM GRID

A "thunderstorm plotting grid" is being used experimentally on United Air Lines non-stop trips from West Coast to Chicago. Devised by Capt. W. P. Miller, it consists of a map of United's airways, divided into coordinates or "grids" of one degree longitude. Each grid is numbered. When radar reports of Weather Bureau shows thunderstorms on or near any segment of UAL's airways, company meteorologists inform Flight Dispatch and the message, "Thunderstorm on Grid 38," for example, is then radioed to UAL's captains on nonstop flights. The captain places a check on the grid where storm is reported, and he then re-plans his strip to bypass the disturbance. This is easier than old method which gave info in terms of cities, etc.

attered industrial plants; it meant that any an, faced with family emergency, could mpress a journey of days into a matter of urs; it meant that the whole of our econ- ny, through routine and reliable air service, uld be kept rolling in its highest gear.

From a national security viewpoint, the ed was equally obvious, and perhaps more gent. The importance of military air trans- rt in moving supplies and troops was grow- g almost daily. Bomber squadrons and ghter wings had to be able to move swiftly om coast to coast and border to border un- r any weather conditions—the tempo of odern warfare does not wait for clear skies nd unlimited visibility. To be sure, the mili- ry services needed specially designed ctical equipment for use in actual fighting nes. But, within the United States and its rritories, every type of military aircraft had move along the airways under poor-weather nditions.

"If the air traffic control system remains ssentially unchanged," reported Senator wen Brewster's Congressional Aviation olicy Board, "the loss (to airlines alone) hat could be expected during the next 15 ears would amount to more than $600 mil- on."

Hidden, intangible, and immeasurable alues were also being lost or discounted. aptain Eddie Rickenbacker, in testimony onsidered by both the Brewster Board and homas K. Finletter's President-appointed ir Policy Commission, expressed the hope hat "within three years, through . . . elec- onics . . . we will be able to eliminate weath- r as an obstacle."

Captain Rickenbacker predicted a 75% ump in traffic if the weather obstacle were emoved. "Currently," he reported, "airplanes ave to sit up there in the air and burn up oney, burn up dollars, waiting to get in." Everybody suffered—travelers in loss of time nd reservations, shippers, public, and private conomy. Safety, whose economic and social alues cannot be over-estimated, was also a ajor consideration.

Inestimable were the defense values, testi- ed then Chief of Staff General Dwight D. Eisenhower, who viewed any investment in ir facilities as sound as long as it did not amage the national economy. The military, e pointed out, was not only "defending ter- itory and property or even just lives. It has een defending a way of life."

On the basis of the testimony of these and cores of other observers in and out of avia- ion, the Brewster Board pointed out that "de- endability of flight schedules is the corner- tone of a healthy civilian air arm," but dded that "regular all-weather commercial ervice has not yet been accomplished. With resent navigational and landing aids, air raffic control and airports, the airways sys- em of the U. S. is near the saturation point, ven for the present fleet of 1,000 aircraft."

Economic loss, poor air service for the pub- ic, imperiled safety, and inability to either xpand or extend air service resulted. These acks were felt by private flying and the mili- ary as well as the commercial operators, and an all-out expansion was recommended.

Aviation experts knew, and the investiga- tive bodies soon learned, that wartime de- velopments pointed toward using Very High Frequency radio. All agreed that electronics was the major problem; since it concerned every airplane aloft, the problem was an enormously complicated one.

Scores of groups in aviation and electronics who had worked on this problem realized that they could solve only small aspects of it alone. Work that they were doing conflicted with work that others did. It was vital, and the Finletter Commission emphasized, that "early agreement on research and develop- ment programs in the field of electronic aids to aviation" must be reached to insure "the means of handling traffic" and to "keep pace with the steadily increasing traffic."

The Finletter Commission recognized that "The Federal Government has, for many years, built and operated navigational facili- ties" for flying but, "before Congress can be expected to appropriate . . . large sums, the various interested private groups and re- sponsible Government agencies must reach agreement on a *common system* of landing aids for immediate installation which will adequately serve both civil and military needs."

Recognizing that there was disagreement among the interested groups, the Wolverton report said that it should be "resolved in the interest of national defense." Another re- port by Congressman Carl Hinshaw ex- pressed the "great need for joint decisions to a *common* end" with "due regard . . . for the public treasury by those responsible for the decisions made."

"Civil and military aviation are indivisible in assessing total American air strength" was the conclusion of the Brewster Board.

But no concerted and coordinated effort had been made.

The reasons for this were soon clear to the several groups studying the problems. All in- terested aviation elements favored bigger and better air facilities, but few, if any, agreed on what kind of facilities should be installed. The issue was clouded, too, by confusion over enroute and terminal navigational needs and how the two would be coordinated.

The Federal Communications Commission, regulatory body for radio, was bedeviled by an expanding industry and faced with finding room for new services as well as for the ex- pansion of existing services. The radio in- dustry was burgeoning with new devices, each of which, according to its sponsor, was the only solution to the problems of the airways. A number of other Federal Agencies con- sidered the airways problem or some aspect of it as their special baby. The Department of Commerce had started airways in the first place, and still ran them. The Army, Navy, and Air Force each had special desires and requirements. Scores of civilian groups sought representation in one of these organi- zations or another and, in addition to all these, were the Air Coordinating Committee, the President, the Bureau of Budget, the

(Continued on page 56)

Air Traffic Story

(Continued from page 55)

Congress, the Research and Development Board, the Civil Aeronautics Board, and the Radio Technical Commission for Aeronautics.

General Milton W. Arnold, Vice President of the Air Transport Association in Charge of Operations and Engineering, reported that while the military had more efficient navigation and ground aids than civilian transport, the risks necessary to certain military operations were such that a separate civilian airways program seemed in order. He recommended more approach lights, Instrument Landing Systems (ILS), Ground Controlled Approach (GCA), radar, and traffic control.

The Navy and the Air Force, more familiar with radar than civil agencies and pilots, were inclined to favor the GCA radar landing system over the civil-type radio-beam ILS.

Both military and scheduled air carriers were generally agreed on the advantages of the Very High Frequency part of the radio spectrum for air-ground communications and also for the newly developed VHF Omnirange (VOR) which sends out guidance courses in all directions instead of being limited to four courses like the low frequency ranges. But lightplane pilots and fixed base operators took a dim view of both, and testified against CAA's airways program.

Urging an investigation of the CAA policy with regard to ILS and VHF Omniranges, "which are useful to only a relatively few aircraft capable of carrying special equipment," Beverly Howard, speaking for fixed-base operators and other lightplane interests, stated that the equipment was "not usable by the private flyer." He added fuel to the many-sided controversy by pointing out that "the Army and Navy have already stopped the installation of ILS and are using instead GCA, which can be used by all aircraft."

These and scores of other problems—contentious, tangled, and highly technical—were detailed at length before such groups as the Congressional Aviation Policy Board (The Brewster Board) and the President's Air Policy Commission (Finletter) with the result that the investigating bodies not only insisted that some agreement must be reached to resolve the controversies but pointed the way toward solution.

A single organization, they recommended, should attempt to bring order out of chaos

The RTCA's Special Committee 31

The President-appointed Air Coordinating Committee, organized to investigate aviation problems and developments affecting more than one Government agency, agreed that a single group should try to resolve the airways problems. This they suggested to the Radio Technical Commission for Aeronautics, a cooperative association of all United States government and industry aeronautical telecommunication agencies, both military and civil.

RTCA promptly organized Special Committee 31. More familiarly known as SC31, the committee was staffed with Federal and industry experts in airways, electronics, equipment, and operational procedures. It went to work on July 30, 1947.

SC31 promptly confirmed the general public, economic, and defense needs for an all-weather common air traffic control system:

"Every (informed) . . . citizen . . . knows well the inability of existing techniques of traffic control to handle the present volume of air traffic, particularly under adverse weather conditions."

Estimates of economic losses under the old system, as brought out in testimony before the Brewster and Finletter groups, were conservative, SC31 found.

"In 1946," SC31 reported, "airlines alone suffered losses of actual and potential revenue from various sources, as follows:

"Cancellations due to weather	$ 6,200,000
Low load factor resulting from unreliability	12,200,000
Congestion at 13 stations at which studies were made	21,100,000
TOTAL	$39,500,000

"Presumably, losses at other congested stations where studies were not made also contributed." While "losses to private operators, military, contract, and non-scheduled services cannot be estimated . . . all-weather flying would be equivalent to increasing our airport values by $900,000,000 even before an additional acre of land is condemned or a yard of concrete is laid."

SC31 found that economics as well as defense needs called for a common system that everyone could use without transitional training: "In the event of a national emergency . . . airline pilots and well-trained private pilots constitute an immediately available reserve on whom the military can draw . . ." But they must be "trained in the use of the system well in advance," calling for "integration of the air traffic control and navigation system with the air defense and early warning system."

Facing the problem at hand, SC31 determined that there were 19 basic air traffic control principles which should be met by the Common System. Boiled down, the 19 points called for an airways system that would be safe enough to separate adequately all aircraft at all times and under all conditions without making exorbitant demands on air traffic control or cockpit personnel, would work as fast and efficiently in bad weather as it did in good, wouldn't break down, and would be designed and equipped to anticipate foreseeable future needs.

The new airways would serve all aircraft, could be expanded to use all airspace, and would keep heavy, complicated equipment on the ground, leaving the aircraft as free as possible from equipment that would hurt its performance. It would be simple to use, would define pilot and ground-crew responsibilities, and would not be handicapped by language limitations. Radio-frequency allocations would have to be consistent with national and international allocations. Cost must be compatible with results obtained.

Having laid down these basic specifications for a Common System, SC31, in great detail, proposed a program and equipment to meet them.

The program would go forward in two phases—a Transition Phase and an Ultimate Phase.

The committee estimated that the Transition Phase could be completed by 1953; the Ultimate by 1963. The transition Phase would rebuild the airways around electronics equipment which had been developed and was known to be effective but was in limited use. Most of the Transition Phase equipment, the committee believed, could form a useful part of the Ultimate Phase airways.

The committee was less specific about what equipment would finally be combined into the Ultimate Phase airways. How effective the devices of the Transition Phase proved to be, changing needs, scientific developments—scores of factors obscured the answers. But SC31 made the broad outline of the need quite clear, and its report served as a huge want ad to electronic engineers—an urgent invitation to invent and develop an airways system capable of handling unlimited traffic at unestimated speeds with unquestionable safety.

Special Committee 31 achieved a near-miracle by winning acceptance from all the previously divergent groups, including military aviation, the airlines, the non-scheduled operators, and the private flyers.

As this is written, the Transition Phase is becoming a reality—not as rapidly as SC31 hoped, owing to the International situation, yet rapidly enough to prove that a *common system* of airways can produce benefits even greater than the committee forecast.

The Transition Phase will not be completed till all installations are functioning; and the Ultimate Phase, as the engineers and operational experts are quick to point out, cannot be achieved by premature optimism and wishful thinking. The knottiest of the technical problems have yet to be solved. Theoretical thinking must be converted into developmental work and that tested in the crucible of practical usage. While the first steps proposed by SC31 have been successful, with marked improvements in airways safety and efficiency, a long, hard march remains before final goals are reached.

Handicapped by a beginning that was confusing and controversial, and threatened with bureaucratic slow death if not starvation from lack of funds, the Common System, its Transition Phase on its way to completion and its Ultimate Phase already beyond the dream stage, promises to become one of the greatest success stories of democratic cooperation in modern times.

Next month—"Elements of the Common System—Transition Period.

Editor's Note: Those wishing copies of the RTCA book "The Air Traffic Story" may purchase them from RTCA at 1724 "F." St., N.W., Washington, D.C. Price: $.50 per copy. This booklet is especially recommended as a textbook for aviation courses in schools and colleges.

Integrated Flight System

(Continued from page 12)

o set the heading marker to an interception eading. It could be, for example, a 50° cut t a course of 100° to an omni-station. If you eep the steering needle centered, you'll hold our interception heading. As the omni-ourse is intercepted, the course bar will ove toward the miniature airplane on the ourse indicator. You then set a new head-ng to your selected omni-course just as the ourse bar begins to approach the center. If ou keep the steering needle centered, you'll urn smoothly onto the new heading.

When you turn onto the omni-course, the ntire center section of the course indicator, ncluding the azimuth ring, will rotate. Then he omni-course and heading will be shown t the lubber line. You correct for wind rift by re-setting the heading marker as eeded and keeping the steering needle cen-ered. The Collins system will operate just as ell on VAR facilities as it does on omni.

The course indicator also makes it easy to ake VOR bearings, providing a quick visual lot or information for plotting a position on avigational charts using two or more sta-ions. To accomplish this, tune the navigation eceiver to each desired VOR and bring the ourse bar to center by turning the course-elector knob. Read the bearings shown by he course arrow, and the *to-from* arrow in he center of the course indicator shows hich end of the course arrow is pointing o the station. It is simple, too, to set up in dvance check crossings of radials. You nerely tune to the desired station and set he course arrow to the check radial. You will ee the course bar appear ahead of the niniature airplane and, as you pass the check adial, the course bar will pass beneath the irplane and fall behind it.

As with any comparable equipment which depends for accurate operation on electronic circuits, the Collins system can get out of kilter. Two important points should be emphasized in this connection. First, both of the instruments are certificated by CAA as primary flight instruments. That means that should the electronic portion of the system fail, the approach horizon continues to function as an artificial horizon, and the course indicator continues to function as a directional gyro. The second point is that the glide-slope pointer on the approach horizon, and the course bar on the course indicator are both operated directly by the glide slope and the localizer receivers just as in the case of the conventional cross pointer. In other words, the Collins system has not interjected any additional electronic equipment into the operation of either of these indicators.

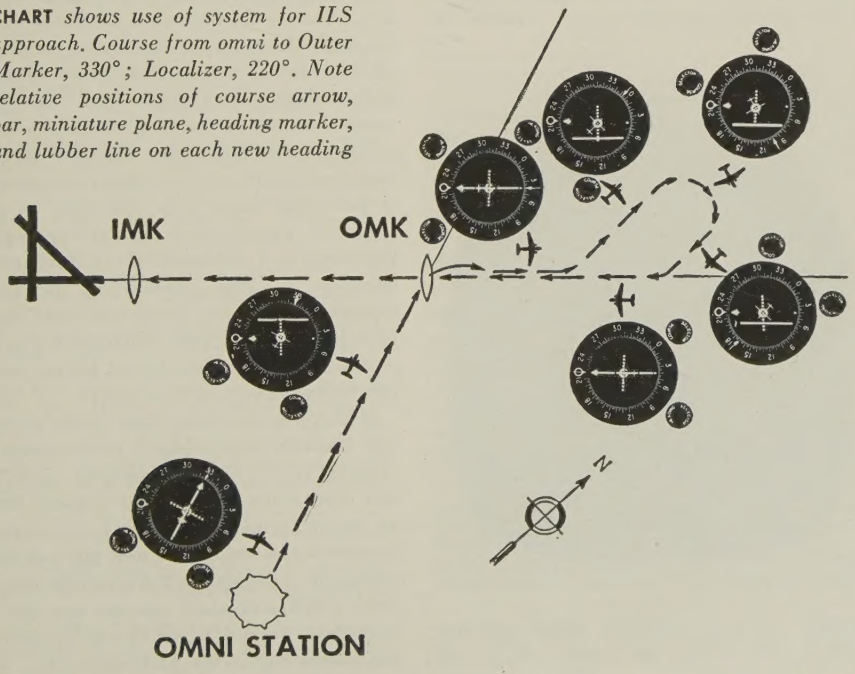
A slight deficiency was noted in using the approach horizon. In level flight the display of pitch attitude is good; however, in a bank, with the steering needle centered, the needle covers up the center reference dots, so that it is difficult to observe pitch attitude during a turn. Re-design of the steering needle shape might easily eliminate this objection.

A thorough pre-flight check of the instrumentation system is mandatory and the manual provides one that is easy to follow.

I mentioned earlier that the Collins system provides the information needed on fewer instruments than are found on the typical flight panel. As a pilot, I'll embrace any system which can eliminate instruments from the cockpit and still give me what I want to know enroute or during ILS approaches. With the Collins system, eight instruments provide what 12 show on a typical panel.

It seems to me also that, in addition to eliminating the need for certain instruments, Collins presents information in a way that calls for a minimum of interpretation. No pilot could ask for more.

CHART *shows use of system for ILS approach. Course from omni to Outer Marker, 330°; Localizer, 220°. Note relative positions of course arrow, bar, miniature plane, heading marker, and lubber line on each new heading*



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- **The Jet Transport Outlook, by R. W. Rummel, Chief Engr., TWA.**
- **Flight Operation Round Table: Present use and future development of the Helicopter.**
- **Automatic Dead Reckoning Computers for navigation of High-speed Aircraft.**

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A Report on DME

(Continued from page 18)

itself to operate within certain specifications of accuracy, we must then satisfy ourselves as to its desirability and operational use. Distance Measuring Equipment can be roughly divided into three areas of operation:—Enroute Navigation, Terminal Traffic Control, and Final Approach.

Enroute Navigation ▶ Distance Measuring Equipment, in conjunction with VOR equipment, does provide us with continuous and accurate distance and course information which would help do away with time-consuming triangulation and computer calculations. By noting the number-of-miles change in DME Indicator readings during a one-minute period and then multiplying by 60, your ground speed is obtainable at any time. And, of course, it is possible for a pilot to check his estimated over-fixes whenever he so desires as he is not dependent upon sparsely located fan markers or intersections. This is obvious since his "distance to go" shows continuously on his DME Indicator.

When enroute from New York to Brownsville, Texas, last winter, I had just passed a VOR station which was DME-equipped and I was told to report over the next VOR station approximately 67 miles distance. While enroute to this station at 6,000 feet, the station I was told to report over went off the air. I was still able to report over my fix by merely watching for the proper reading on my DME Indicator and we were not required to clutter up the airways with unnecessary radiotelephone procedure.

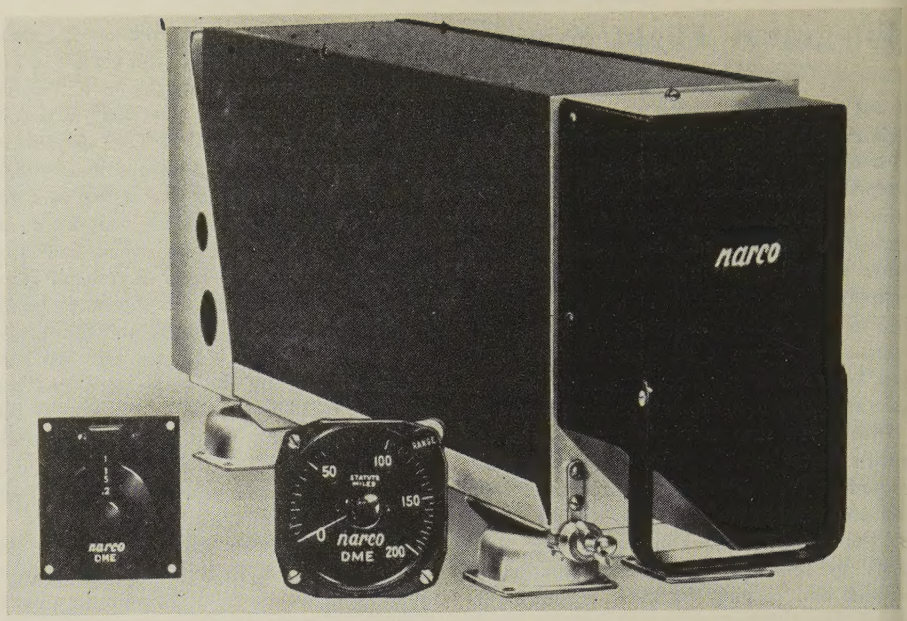
Terminal Traffic Control ▶ Were DME to come into use in Terminal Traffic Control, it should lead toward a more efficient use of airspace and more expedious movement of aircraft. This would be a result of more accurate and rapid reporting of positions, allowing altitudes changes at shorter intervals in heavy traffic areas. Holding patterns could be made accurate as they would be based on actual distance covered. An aircraft could be assigned to hold at any radial for any given distance on a VOR/DME installation. The holding points would no longer be limited to range intersections, fan markers, compass locators, etc. I have tried holding patterns on VOR/DME installations and have found that I can maintain my position on a given radial (example, 270°) within assigned limits (example, 18 to 21 miles from a VOR/DME installation) and my pattern would remain the same regardless of the effect of high crosswinds.

It might further be possible that, through the use of DME, take-offs could be expedited as the second plane would not have to wait five to seven minutes until the first plane has reported "on top" or over some fix.

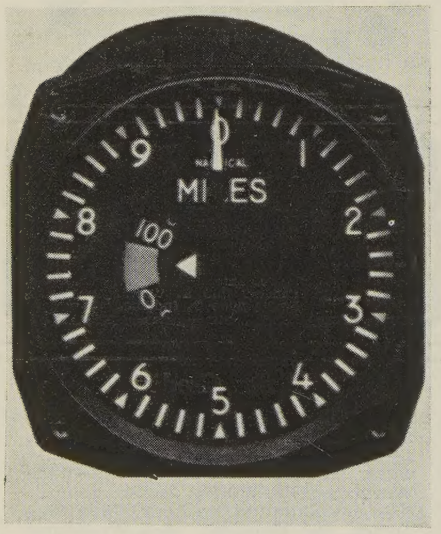
The Final Approach ▶ I feel that we have a great deal more testing and evaluating to do before we can completely satisfy ourselves as to the use of such equipment on the final approach. I have used the DME on many practice ILS approaches and it does accurately present "distance-to-go" right down to the threshold of the runway, but it is difficult for the pilot making the low ILS approach down to 200 feet to divert a part of his attention to another instrument. It would seem more practical for the copilot to call out distances as required by the captain. This, however, would lead to more talk in the cockpit which is something we try to steer clear of.

It appears that a more practical solution would be to have the DME illuminate a series of lights at preset distances as described previously. Then, were the DME to come into universal use, fan markers would become obsolete. This would mean that regardless of where you were making an ILS approach you would receive an indication of distance from the DME Indicator at the same position on all ILS installations. This could eliminate the problem of location of outer and middle markers which varies at all installations due to terrain, available land, etc. The fact that there would be more accuracy in reporting of positions, would also lend itself to a decrease in the interval between approaches. However, as I indicated previously, our experience is rather limited on the use of Distance Measuring Equipment on low approaches and more experimentation and evaluation must be accomplished before we can have sound operating procedures.

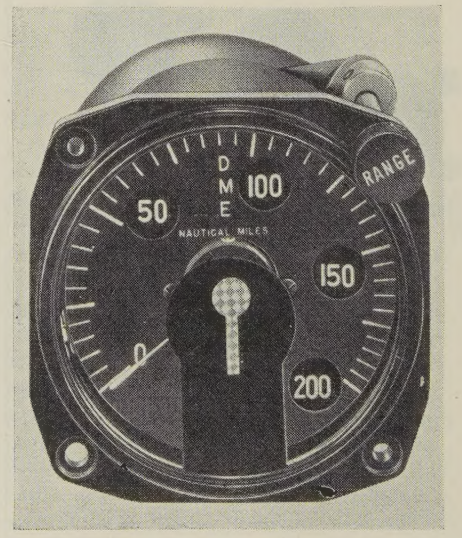
If there is one thing that keeps the aviation business interesting, it is the continuous availability of newly developed equipment and procedures. DME is one of these. We are all trying to find out what we can about the operation and use of this new piece of equipment, but I believe that within the next five years DME will come into its own and will become as normal a part of our flying as the omnirange has in the past five years.



NARCO *recently announced its new DME which was developed according to specifications prepared by the CAA's TDEC under a project sponsored by the Air Navigation Development Board*



FEDERAL *model features rotating hand indicating unit miles, window showing 10's*



BENDIX *features voltmeter type indicator calibrated in miles; two scales: 40 or 200*

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CESSNA 195 FOR 1953

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Engineering changes include a larger flap which permits steeper approach to a landing, and reduces ground roll by 12%. A redesigned elevator coupled with a relocation of horizontal stabilizer gives a smoother ride in all weather conditions.

The five-place 195 for 1953 retains the 300-hp Jacobs engine (or 275-hp Jacobs), Hamilton Standard constant-speed prop, etc. It cruises at 165 mph at 7,000 feet, 70% power, and has a range of over 750 miles, with 220 pounds allowable luggage.

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